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# GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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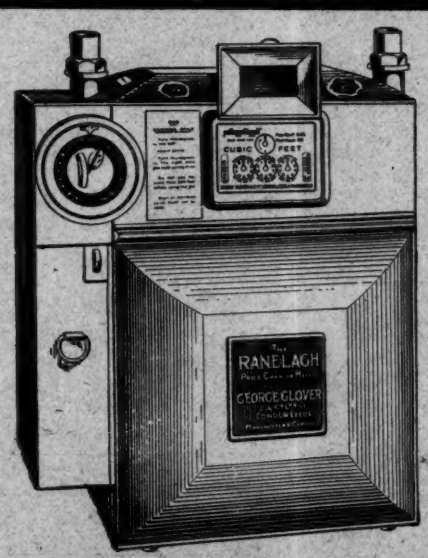


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VOL. CLXII., No. 3136.] WEDNESDAY, JUNE 20, 1923. [75TH YEAR.


## EDITORIAL NOTES.

### The Work of the National Gas Council.

ALTHOUGH not a commercial undertaking, the National Gas Council, if rightly regarded, is one of the most productive organizations we have, in that, through its political operations for the gas industry, it largely protects it against the infliction of uneconomies, brings its power to bear upon the obtaining of concessions and relief, and works—not always successfully, but mostly so—in bringing about the easing of proposed new conditions in connection with its operations which might otherwise mean additional substantial burdens. The report presented by the Council, and the address of the President (Mr. D. Milne Watson), at the annual meeting last week, provide confirmation of this, and more. The industry works for economies in its various manufacturing processes, it operates with the view to produce satisfaction among its consumers; but there are those influences and activities outside the industry which, if they had an unimpeded way, would heavily discount its internal efforts. It is in taking the offensive when necessary, but more often in acting on the defensive, that the work of the Council lies. That the work is efficiently done is recognized by the major part of the industry, as is disclosed by the fact that the total number of undertakings subscribing to the funds of the Council at March 31 last was 841, representing 87 p.ct. of the total make of gas in the United Kingdom. In these figures we see a verdict of approbation and appreciation which it would be sheer folly to contest.

In the introductory remarks to his address, the President described the past year as a "notable" one; and it was so not only for the industry, but for the Council. The Council have always some work in hand—always something to engage thought, and to demand action. There is little rest for those in charge—from the indefatigable President and his fellow councillors on to those who, under their direction, look after and perform the executive functions. The year has proved that the greater the industry becomes, the more its operations extend, the more it invites attention to itself, and the greater the surface it exposes. This cannot be helped; but the industry must always be prepared with the machinery to deal with such positions and all emergencies. The unexpected has a nasty way in respect of its incidence; and the industry is not permitted to select the time. The past twelvemonth has had its illustrations of this; and the Council have been found watchful and ready. There have been the venomous campaign regarding carbon monoxide, and the foolish arraignment of the therm as a device possessing the latent power of increasing gas accounts sporadically wherever it is adopted. The inquiry by the Therm Charges Committee completely dissipated this nonsense, and placed the therm system in a stronger position than before.

But upon this and the carbon monoxide campaign came the related matter as to whether additional precautionary measures could be taken in connection with the distribution of gas. There was the conference at the Board of Trade, at which the National Gas Council again stood in front place. The most important of the possible issues from this conference is the recommendation as to the inspection and testing of consumers' appliances. The President first indicated caution, and his great respect for the Englishman's home. But then he went on to show that there is good ground for gas suppliers having more concern than in the past for both the Englishman and his home, and using their expert knowledge to fill up the blanks in the knowledge of their customers. Mr. Milne Watson said: "It is an undoubted fact that "many appliances are to-day offered for sale which cannot "be termed either safe or satisfactory; and any accidents "that occur, in consequence of the use of such appliances "or apparatus, must of necessity be detrimental in the "highest degree to the gas industry as a whole." There we have one reason for what is proposed put into a nutshell. We would add another to that of the President. We talk a great deal about the dependence of the industry upon a satisfied public; but all the efforts that are made in this direction are in many houses annulled by the inadequacy of the carrying capacity of the piping. There we have a reason for powers of supervision and specification in respect of house piping. Safety and satisfaction should guide decisions in this matter. We agree absolutely with the President that, "if it be decided that, in the interests of public safety, "additional powers on the lines I have indicated should be "conferred upon the industry, then it is clear that these "powers should only be exercised with the utmost caution "and tact." Of course, such powers would not be exercised arbitrarily, but only to secure the safety and satisfaction which are so highly important to the interests of gas undertakings. However, the President assures the industry that its representatives at the conference will, while protecting its legitimate interests, do everything in their power to allay any doubts or suspicions that unfortunately may be prevalent to-day.

This latter matter, of course, hinges on the attack upon the industry in respect of suicides by gas and rare casualties due to accidents—"rare" having regard to the extent of the use to which gas is applied in this country. A great deal of nonsense was written about this matter; but it has died down somewhat, though in the Press there is a little stirring of the embers now and again. But upon this came the public Press references to the carbon monoxide reduction process, which the gas industry does not want, nor those consumers who have any knowledge of the valuable heating property of the much-reviled (by nescience) constituent. The President regrets the booming in the daily Press that the process received; and the language he employed in regard to this was very modest compared with the expressions of opinion heard elsewhere in the ranks of the gas profession. The ground of the President's regret is not only "because it may be detrimental to the industry as "a whole, but also because it is distinctly misleading to "the public." These and the accompanying remarks were heartily endorsed by the large meeting of representatives of gas undertakings. We are inclined to think that the President is quite justified in saying that a much more beneficent and just attitude towards the gas industry has been shown recently. He adds the belief that "if the public can only "be kept informed of the many and great services rendered "by the industry, and the care which it takes to satisfy the "needs of its consumers in every way, we shall be in a "much stronger position in the future to meet any campaign, "whether public or personal, that may be launched against "us." We hope a way will be found to keep the public better informed. Perhaps one has been. Whether so or not, this is a matter that has greatly interested us in the past, and continues to do so, because we are fully persuaded that the last two campaigns would not have reached the intensity they did, had the public known more of the industry and of its work. In regard to the carbon monoxide campaign, the report states: "Machinery has now been set up "to cope with this question. Watch Committees have been

"formed in the Provinces, and adequate steps have been "taken in London and the Home Counties to counter the "many unfounded statements that have been made." That is a good step; but Watch Committees are not sufficient to cover the need previously expressed by the President as to keeping the public informed. "Keeping the public informed" suggests improved educational propaganda. How best to effect this is the problem before the industry.

In the early part of this article, allusion was made to the fact that the National Gas Council was, though a body largely concerned in the political interests of the industry, one which, through its operations, has a material influence upon the economical working of gas undertakings, which means money. We will not discuss the matter, beyond pointing to the work that has been done in connection with the Factory and Workshops Act, 1901, and the Chemical Works Regulations, 1922. The action of the Council in this connection will particularly favourably affect the small gas undertakings. There is the pressure that has been consistently exercised in respect of lower railway rates for coal and coke; and there is the question of workmen's compensation insurance. Here the great value of co-operative effort is exemplified. The President stated that gas undertakings to the number of upwards of 200 have been enabled to reduce the aggregate amount of their premiums by no less than £10,000 per annum—equivalent to about 60 p.ct. of the whole income of the Council. As and when more members avail themselves of the scheme, it is confidently expected that the rates will be further reduced. Then there is the protection of the interests of the industry in respect of the use of tar for road improvement purposes, and in securing modifications in the revised specification for road tar. There is also the standard cooker, which the President expects will meet the requirements of the industry for hiring-out purposes; and he has no doubt that it will enable a considerable saving to be effected not only in the initial outlay, but in the cost of upkeep. Several other matters are referred to in the Council's report and the President's address, but those mentioned will suffice as examples of questions that have been dealt with which bear upon the financial interests of the industry. The year, indeed, has been a notable one in the annals of the Council; perhaps it should rank next to the year in which the Gas Regulation Act was passed.

## Fuel Board Changes.

The regret expressed by the Lord President regarding the resignation of Sir George Beilby, LL.D., F.R.S., from the positions of Director of Fuel Research and Chairman of the Fuel Research Board of the Department of Scientific and Industrial Research, will be shared by every professional man in the gas industry. Sir George has a place among us which he has long occupied not only on account of his scientific attainments, but through personal characteristics of an order which never fail to draw men. He has tenanted the offices mentioned for seven years; and, during the whole of that time, his services have been rendered voluntarily. For this alone, he merits the recognition of his country, and not less, among others, of the gas industry. It was work which had attractions for him; and for it his scientific attainments and experience richly qualified him. A national institution of the kind being something new, Sir George had upon his shoulders the responsibility of all the initial work of establishing this important branch of the Department of Scientific and Industrial Research; and this with all the drawbacks that wartime—with its tightness of money, shortage of material, difficulties of constructional operations, and provision of equipment—could thrust upon him. But, with his staff, he persevered until the station and its equipment were realized; and then he threw himself heart and soul into the work which was to have as its goal economy and efficiency in the utilization of fuels. In the investigations he has been an inspiring force, and critical supervisor—he has been the Director not only in name, but in fact and deed. Much has been accomplished; much more remains to be done. Fuel research bids fair to be a never-ending subject for the scientist, and for industry and the country generally; but all such research must in some way or other contribute to the national economy, or to a greater independence by this country of other countries. This work should never be allowed to collapse. As a nation, we have done little enough in the way of research; and more instead of less should be undertaken. However, from the Directorship we part with Sir George; but it is a pleasure to know that he will retain his membership of the Advisory Council of the Department, and has consented to act as Hon. Adviser to the Board.

The resignation has necessitated changes; and the opportunity has been taken to strengthen the Board by incorporating men of scientific qualifications and practical experience in other industries. In the first place, Dr. C. H. Lander, until now Assistant to Sir George, has been appointed to succeed him in the Directorship. Dr. Lander has been an assiduous seconder of the efforts of his late chief; and during the association his contributions on the subject of fuel to various technical organizations have been many and enlightening. Sir Richard Threlfall, K.B E., F.R.S., who is a member of the present Board, has accepted the Chairmanship. The Hon. Charles Parsons, K.C.B., F.R.S., also continues to be a member. Scientifically and industrially, the Board is greatly strengthened by the inclusion of Mr. R. A. Burrows, Sir John Cadman, K.C.M.G., D.Sc., Dr. Charles Carpenter, Mr. Samuel Tagg, Prof. Sir James Walker, D.Sc., LL.D., F.R.S., and Prof. R. V. Wheeler. Gas, mining, petroleum, and fuel generally are well represented by the new additions to the Board. Of course, there cannot be any large extension of research with funds somewhat curtailed; but, with such a Board, one may rely upon the money expended being utilized to the best possible advantage.

## Prospects of the Oxygen-Steam Process of Gas Making.

Hopes rise and fall regarding the prospects of realizing in gas making the 90 p.ct. efficiency which Cobb and Hodsman in this country and Jefferies in America have put before us as an ideal and a possibility by the oxygen-steam process—providing oxygen can be obtained cheaply enough. We desire to get rid of that heavy loss in the blow period of water-gas manufacture which occurs, even when a waste-heat boiler is used, through the heat carried away by the nitrogen at high temperature. Sometimes hopes have been raised that the cost of oxygen production will come down to a figure which would enable this to be done; but hopes in this respect are not long maintained at a high level. They are again damped by Mr. T. Campbell Finlayson, who has been making an experimental investigation for the Woodall-Duckham Vertical Retort and Oven Construction Company, Ltd. In doing this, no doubt the enterprising Company had an eye to gas-making developments if a means of making economically a satisfactory strength of oxygen could be discovered; but the issues of the investigation have not been those that would have been heartily welcomed and valuable. Nevertheless, the chemical world and the gas industry are indebted to the Woodall-Duckham Company for what they have done in this regard. Explanations as to the course and the results of the investigation were embodied in a paper which Mr. Finlayson submitted to the Institution of Chemical Engineers at their first annual meeting, with Sir Arthur Duckham, the President, in the chair. The paper was a voluminous one, and covered a large area of ground composed of oxygen production by various processes, and industrial applications. It indicates a very thorough research into both processes and possibilities. From the paper we give extracts in later columns, together with a report of the discussion.

The question which it was sought to answer was: Is a process available by which industrial oxygen can be obtained at 1s. per 1000 c.ft., and which involves a low capital expenditure. Mr. Finlayson has examined the various existing processes; and we may say at once that his answer to the question is in the negative. He has also made research into one which is named the "pressure-fractionation" process, and which appears to have found favour with him more than any other. But even in this case, all he can say is that 30 to 40 p.ct. oxygen could be produced "probably" at a reasonable price. For such oxygen strengths there would not be much demand for gas-making. If, however, a substantial economy could be shown in producing a 60 p.ct. oxygen rather than 100 p.ct., then (as will be seen presently) the former would be more suitable than the latter for gas-making purposes. The "pressure fractionation" process, however, becomes more inefficient when attempts are made to produce 60 or 70 p.ct. oxygen at an economic figure. The plans that have been considered by the author for doing this have all failed.

Of course, one cannot deny that, given a cheaply produced oxygen, there are economies in the oxygen-steam process—realizable in obtaining more efficient gasification (good gas being obtained in both the blow and the run periods), and in heating by internal rather than by external means. It is through the losses of the blow period being abolished, and the higher efficiency of internal heating over external, that the gas-making efficiency of 50 p.ct. is obtained. An interesting part of the paper is the examination of the price that the gasmaker could afford to pay for oxygen; and Mr. Finlayson bases the calculations he instituted in this connection on the difference between the 56 p.ct. efficiency of a water-gas plant, working with waste-heat boiler, and that of the oxygen-steam plant at 90 p.ct. Taking these two efficiencies, the saving of fuel would be with the steam-oxygen process 34 tons of every 100 tons required in the water-gas process. The oxygen needed per 100 tons is equal to 1,200,000 c.ft. If the price of the fuel is 25s. per ton, it is found that, from the thermal point of view, there is provision (in the 34 tons saving, at 25s. per ton) of 8½d. per 1000 c.ft. of oxygen as the maximum price. This is 3½d. lower than the cost of 1s. per 1000 c.ft. for oxygen, upon which the investigation was based. There are, however, other factors to be considered—such as capital and running costs. The suggestion is that the introduction of the oxygen-system producer would greatly lower the capital costs of a gas undertaking. As Mr. Finlayson points out, if this be the case, consideration must be given to the combined cost of the oxygen plant and the gasification plant, which must be less than the cost of the present plant. The same applies to running costs. The combined oxygen and producer plants must employ less labour, &c., than the present plant. Nothing has yet been advanced in the way of conclusive data bearing upon this point.

In a previous paragraph of this article, the remark is made that, if a substantial economy could be shown by producing a 60 p.ct. strength oxygen rather than a 100 p.ct., the former would be more suitable than the latter for gas-making purposes. Mr. Finlayson has been investigating the results from the use of various strengths of oxygen. It is found that the efficiency of strengthening the calorific value of the gas does not coincide with the work done in nitrogen removal. An illustration or two will show what is meant by this. Using an oxygen, enriched air containing 50 p.ct. oxygen, it is found that 75 p.ct. of the total work of nitrogen removal has been done, yet the efficiency of strengthening the calorific value of the gas is only 64·5 p.ct. If a 60 p.ct. oxygen is used, the calorific value of the gas made is 314 B.Th.U. per c.ft. Cobb and Hodsman using 100 p.ct. oxygen obtained 352 B.Th.U. per c.ft. There we see a difference of 40 p.ct. in oxygen, but an increase of calorific value of only 11 p.ct. Table II. in our report is worth studying in this connection. The results indicate that there appears to be a limit beyond which it would not pay one to oxygen-enrich the air. However, the main conclusion of Mr. Finlayson's investigation is the one already mentioned—that no process has yet been devised which will give supplies of oxygen by a simple process at a price not exceeding 1s. per 1000 c.ft.

## Business Getting and Business Keeping.

THE methods of getting new business in the gas industry are many and varied. The best of them are not practised by all gas undertakings, though they should be. But it is one thing to get business; it is another thing to keep it when obtained. The methods of keeping it have their origin in four places: The administrative offices, the gas-works, the distribution system, and at the points of use of the gas-consuming appliances. The ability to retain means producing satisfaction for the consumer; and the satisfied customer is the best advertising medium a gas undertaking can have. By some readers this last remark may be regarded as a platitude; they would be right in so regarding it. It is, however, believed by us—if the laxness of some gas undertakings is a fair basis for judgment—that what is a commonplace to many gas men, is a perfect novelty to others. Strange as it may seem to progressive men, there are undertakings that do not concern themselves in any way as to whether gas is being used properly or improperly in the houses of their customers. They are living amid the competition of 1923, and accepting the practices of 1823, which have descended to them by the process of tradition. They say: "What was good enough for our great-grand-"fathers, our grandfathers, and our fathers, is good enough "for us." This may show a spirit of respect for our ancestors; but our ancestors, were they here, might count those men as fools for not shaping their methods and practices to the requirements of our times and not theirs.

The Bournemouth Gas and Water Company is a model for business getting and business keeping acumen in respect of their gas undertaking. They get business, and they retain it; and this is done by an activity which was well portrayed in the proceedings at the Southern District Conference of the British Commercial Gas Association last week. The Company's management, now and in the past, has been wide-awake; and the Bournemouth operations alone supplied sufficient ground for an excellent meeting, paper, and discussion. Any who were present who do not follow their practices or similar ones must have gone away with a deeply rooted resolve to go and do likewise; for both in the speech of the President (Mr. William Cash, the Chairman of the Company) and in the paper by Mr. P. G. G. Moon, the Engineer and General Manager, on "Sales and Service," there were data which proved the efficacy of methods in procuring and preserving business, and in utilizing what is obtained in securing more. The Company have always been progressive. In the Chairman's address, he supplied statistics as to the increase in consumption over a long period of years. Let us take two figures—those for 1907 and 1922. In the former year, the consumption of gas was 635,774,150 c.ft.; in 1922, 1,514,011,888 c.ft.—an increase of 138 p.ct. in fifteen years. This is an excellent showing; and we have to pass to Mr. Moon's paper to obtain the details of the sales and service policy that has brought this to pass. It is clear that Mr. Moon, like his predecessor (Lieut.-Col. H. W. Woodall), is not favourable to anything being left undone that can be done to secure and retain and still further expand business. He is a strong believer in the proper distribution of gas throughout a district, in testing apparatus in order to see that the most efficient types are adopted, in selling and properly fixing the apparatus in consumers' houses or other premises, in educating the consumer in its economical use, and in the efficient supervision and maintenance of the apparatus afterwards. Any man with such a policy, within the limits of his district must succeed; but the methods which he adopts in connection with each phase of the work are, of course, highly important. There are degrees of effectiveness in methods; and the most effective, in the circumstances of each area of supply, are the ones to be sought for and, when found, applied.

In the section of the paper on gas sales methods, the author made several suggestions (which are the practices of the Company) in connection with advertising, and where to place advertisements. We will not refer to them all here; the paper will be consulted by those interested for the purpose of obtaining full information. But we should like to endorse the view that in newspaper advertising it is better to put forward a policy rather than a price-list—to preach a gospel rather than waste the space and money on advertising the prices of mantles and other accessories. Passing on, newspaper editors and members of the local governing authorities should be kept well informed regarding gas matters. An important thing, too, is to get announcements in the booklets, &c., published by local house and estate agents; and to obtain from the agents the names and addresses of prospective new residents. To these are sent suitable literature and a letter inviting the recipient to meet a representative of the Company at the new home. This has been very successful. We are not so sure as to the value of the "Demand Note" as a vehicle for conveying information regarding the uses of gas. The only thing that counts on a demand note is the amount the consumer has to pay; and when this is ascertained, interest somewhat flags in all else that appears on the note. Favourable attention is drawn by Mr. Moon to the special literature of the "B.C.G.A." for different professions. In this connection, the interesting particulars were given that in the Bournemouth gas-supply area there are 142 doctors, 134 of whom use gas for heating, two electricity, and six anthracite or ordinary coal only. The 134 doctors have betweem them 113 gas-cookers, 415 fires, and 56 water-heaters. A recent canvass obtained from among them orders for an additional 4 cookers, 23 fires, and 4 water-heaters. Some excellent points were made respecting canvassing. Upon the selection and training of canvassers, too much stress cannot be laid. The Bournemouth Company prefer trained gas-fitters

who have had the craftsman's experience of fixing and maintaining every class of apparatus the Company supply. Those so engaged "have been chosen because of their good "address and general education, and have been specially "trained to deal with consumers on tactful and efficient "lines." Whatever may be the views on the subject in other gas undertakings, in Bournemouth good results are realized from the payment of commission to inspectors, showroom managers, canvassers, and other employees, as well as to builders, ironmongers, and gas-fitters. Last year the commission received by the Company's employees amounted to £995, and by outside agents to £1394. Again, since the bedroom gas-fire propaganda was started, 2600 fires have been installed in hotels and boarding-houses. Sound advice was given by the author as to the management of showrooms; and incidentally it is seen that the sale of gas-lighting glassware in Bournemouth has been discontinued, owing to the development of the sale of silica globes and shades—upwards of 10,000 pieces now being disposed of annually.

The author also spoke of the value of exhibitions; and a little later in the paper he supplied information as to the maintenance charges in vogue in the Bournemouth area. The methods of control of district work are also comprehensive, and will well repay study by other gas managements to ascertain whether they can improve upon their own procedure, or show Mr. Moon how he can obtain a still higher degree of efficiency. Mr. J. W. M'Lusky, of Glasgow, was present; and, speaking on the point as to the maintenance of consumers' appliances, he gave a good account of the experimental scheme in one of the Glasgow areas. In that scheme of maintaining gas-lighting burners and cooking and heating appliances, the labour is free, and all material used is charged for. It is anticipated that, by reducing the cost of attending to complaints, it will ultimately pay for itself; in the meantime, it will cost from 1d. to 1½d. per 1000 c.ft. of gas sold. He added that there has been an enormous reduction in complaints, and a great increase in satisfactory supplies in the experimental area—in fact, the portion of the community in the area was never before so well supplied. He feels confident the Corporation will be induced by the experience to apply the scheme throughout the city. Of course, the lessons of the experimental area scheme must assure that important step being taken. It should not be overlooked so far as cost is concerned that the experimental work has been done on the rough ground provided by expert maintenance not having been carried out before; and therefore the cost of inspection and maintenance within the area will now be reduced, though even at the present moment, having in view the lighter cost of complaints, it is not to be grumbled at as an addition to the cost of gas.

Naturally much was said during the conference as to the effective services of the "B.C.G.A." Mr. Moon referred to them in various places in his paper—more especially in connection with national advertising, the assistance rendered to subscribers in respect of illustrations and suggestions, and through pamphlets and other publications. We regard as of infinite importance, too, the present policy of the Association in not only working for the present, but in projecting their efforts so as to have effect in the future. They are working assiduously among the generation of potential customers—those who will be the housewives in years to come. This is good expenditure on the insurance of the gas business, and in providing for its expansion. We find this in the remarks of Mr. F. W. Goodenough, the Executive Chairman of the "B.C.G.A." In its advertising policy, the motto of the Association is at present "Concentration." Pursuing this policy, much is being done in the medical and educational papers. Mr. Goodenough is convinced—and he will have the support of every sentient gas man—that the publication of helpful articles for the information of teachers, and the use that is known to be made of them in instructing the next generation of gas consumers, will prove to have been worth an enormous sum of money to the gas industry. There will not be a dissentient voice as to this; for knowledge as to the uses of gas and the management of appliances so gained now by children, means that the knowledge will be applied in the future. There can be no question about this, nor about our assertion that, in the years to come, it will ease the work of business getting and instruction. Had similar work been done in the past, there would have been less need for the intensity of operations in the present; and there would have certainly been less display of foolishness in the public Press—such as the industry has had to counter during the past year. All will be wise who support the Association in their educational propaganda.

There was much in Mr. Moon's paper and the discussion upon it that is of value to the managements of gas undertakings, and especially to those responsible for the commercial part of the business. This is just as vital as the manufacturing part of the work of a gas undertaking; and it is more exacting. On the works, quantities, quality, and pressure have to be served; in the area of supply many thousands of consumers may have to be satisfied, and each with a number of points of consumption, divided up into various purposes, and therefore with greatly dissimilar appliances. That the sale of gas, and the maintenance of the business gained and of the growth of gain, have become an art and science is demonstrated by the Bournemouth Conference.

## A New Fertilizer from Gas and Coking Works.

IN later columns of this issue, Mr. E. Lloyd Pease introduces the "N.P.K." fertilizer, which is produced by a process for which patent protection has been obtained, and which, we are sure, will not appeal in vain for the interest and consideration of the gas profession. The author of the article describes the process and what it accomplishes with a clearness and conciseness which put one into immediate touch with the virtues claimed for it, and which he is confident, from his experience with a small plant working on a commercial scale in conjunction with coke-ovens, will be fully confirmed in any circumstances in which it may be applied. The article does not include working costs; but the author states emphatically that the process "provides a cheap "and effective way of extracting ammonia from gas." This alone will be sufficient inducement to penetrate further into its merits; and from what is stated one imagines the over-all costs will be low. Of course, at this juncture, an independent opinion cannot be expressed upon the process, other than that we know Mr. Lloyd Pease would not put it before the gas and coking industries unless he had satisfied himself on all points—especially as to the efficiency of the process, and of the product as a fertilizer. In fact, in the latter respect he asserts its superiority over sulphate of ammonia; but actual results are not given, though it is hoped in a few months to be in a position to furnish them.

In the very first two lines of the article, the author and inventor gives us the composition of the fertilizer, when he says it contains nitrogen, phosphates, and potash, and is produced in the process of scrubbing gas for ammonia. By this method, the ammonia is extracted; and by the same operation it becomes a constituent part of the fertilizer. This foreshadows simplicity. The article, too, makes it abundantly clear that the process cannot fail to ensure an intimate admixture of the ingredients, which is highly important to the realization of the highest efficiency in application and effect. Instead of sulphuric acid, phosphoric acid is used; the fixation value of the latter for ammonia being stated as higher than that of the former, besides which it possesses essential manurial properties. Only a crude phosphoric acid is required. To this is added the desired percentage of potash; the solution being mixed into a finely-ground material—such as coke, shale, peat, clay, &c. Peat is particularly mentioned as having highly favourable points as a constituent. When the acid base is brought into contact with gas containing ammonia, the latter is "completely" extracted, and combined as di- or tri-ammonium phosphate. The base material emerges from the plant as a dry fertilizer, containing all the manurial ingredients required, and in such proportions as may be arranged. This is a brief outline of the process; but it and the plant are dealt with in greater detail in the article—all tending to show that the latter is simple, and the former efficient and more economical than the old sulphuric acid process. There are no effluents; and no steam or power is needed, except for the mixing-trough and revolving tube. A ready market is predicted for the fertilizer.

The article indicates that the author has made thorough investigation of the process; and the claims constitute an invitation to gas engineers and chemists to give to it very careful consideration. Relief of gas-works from sulphuric acid purchases and from troublesome effluent will be regarded, apart from all else, as commendable features in a method for the production of a fertilizer. Working experience with the plant and process and with the product will, it is hoped, corroborate the confidence of the inventor. Time will show.

### The Carbon Monoxide Reduction Process.

The National Gas Council have arranged for an inspection and report to be made regarding this, as soon as a plant is known to be actually in operation demonstrating Mr. Tully's process.

### Federation of Gas Employees.

The annual meeting of the Federation of Gas Employees was held yesterday week; but we imagine there could not have been any topic of great moment to discuss. During the past year there have been quite a number of more or less incidental, and not fundamentally important, matters which have called for discussion, negotiation, and settlement. The Federation are on such good terms with the Unions immediately identified with the industry that all these questions are dealt with in an amicable give-and-take spirit. That is how things should be. The year has been singularly free from any disturbance or unrest on the part of gas workers. Such local difficulties as there have been did not develop to anything of a really serious nature. There are indications that the relationship between employers and employees has still further improved. The satisfactory labour position in the industry to-day is largely due to the fact that the employers have taken pains to ensure that the conditions under which the gas workers are employed are such that they are encouraged to perform their work in the most efficient manner possible.

### Corrosion of Gas-Pipes and Meter Parts.

In an article in other columns, Mr. H. E. Williams, of Manchester, advances argument and experimental results against hydrocyanic acid being accepted as the chief cause of corrosion of gas pipes and meter parts; and he agrees with Mr. B. Richardson and Mr. J. M'Leod that the main cause is due to the alternate action of carbon dioxide and oxygen in the presence of water. Mr. Williams' experimental work (using tubes filled with iron wool), he says, demonstrates that the corrosive action is due to carbon dioxide, and not to hydrocyanic acid; for whereas when the carbon dioxide was removed from the gas, and an equivalent quantity of hydrocyanic acid was liberated in it, no corrosion took place in one tube, yet considerable corrosion resulted in a second tube, on the same gas stream, when the hydrocyanic acid was absorbed, and an equivalent quantity of carbon dioxide was liberated. A further experiment was made by passing a portion of the gas through a sodium cyanide tower to increase the hydrocyanic acid content while removing only a portion of the carbon dioxide, so that the iron wool could be acted upon by carbon dioxide and hydrocyanic acid simultaneously. The iron wool was rapidly corroded, and finally turned blue. The carbon dioxide in the gas attacked the iron, forming ferrous carbonate, which was partly oxidized to ferric hydroxide by the action of the small quantity of oxygen in the gas, and partly converted into ferrocyanides of iron by the hydrocyanic acid. So Mr. Williams asserts that the corrosive action of gas is chiefly caused by the carbon dioxide and moisture present in it; this action being greatly accelerated by the oxygen present. The ferrous carbonate first formed is oxidized to ferrosoferric and ferric hydroxide, with liberation of carbon dioxide for further destructive action. The results of the experiments, taken in conjunction with the fact that in modern gas the carbon dioxide averages 2 p.ct. or over, and the hydrocyanic acid not more than a few grains per 100 c.ft., our contributor says, show that the latter may be ruled-out as a direct corrosive agent. The point might be discussed on the report of the Life of Gas-Meters Joint Committee at the meeting of the Institution next week.

### Railway Rates for Coal and Coke.

The National Gas Council are approaching the Mining Association with a view to joint action being taken to secure further reductions of the rates obtaining to-day for the conveyance of coal and coke by rail.

### Housing Schemes and Government Assistance.

In a speech at the Southern District Conference of the "B.C.G.A." last week, Mr. F. W. Goodenough, Executive Chairman of the Association, remarked that, as the result of negotiations with the Government, gas undertakings have received large sums of money towards the cost of gas installations under the housing schemes, which they certainly would not have had unless a very strong fight had been put up. He does not think he is over-estimating it when he calculates that the industry has received at least half-a-million of money in this way since the public housing schemes were started. There is much work done by the Association upon which one cannot put a money assessment, but which is of considerable financial value to the industry. But here we have a definite figure in respect of one gain. Half-a-million of money at 5 p.ct., tax free, would provide the Association with another £25,000 a year to expend to the advantage of the industry.

### Improved Coal Exports not Permanent.

Speaking at the annual meeting of the Central Association of Miners' Permanent Relief Societies last Friday, the Earl of Crawford warned those interested that they have no right to consider that the coal trade improvement has yet gained an element of permanency. What is happening is that this country is merely furnishing what was formerly supplied by producers elsewhere This is true; but it is hoped that a portion of this increased trade will be retained, or, at any rate, that part which was in the possession of this country before the war. Through the additional export demand, the rate of unemployment in the mining industry has been reduced, and mines that had been closed have recently been re-opened. At the same time, it will not do to place too much dependence upon the present position. There being a decreased supply from other countries, it cannot be said that there is a fundamental increased demand from this one which will be permanent. When normal conditions are reached elsewhere, the distribution of demand is bound to undergo some change.

## THE RARE EARTHS.

At the Mining Exhibition in London, on Thursday, June 14, Mr. Edmund White, of Messrs. Hopkin and Williams (Travancore), Ltd., read a paper on this subject.

The author stated that the rare earths comprised a group of elements allied in many ways to the alkaline earths, and were so named because at the time of their discovery they were only known as constituents of a few minerals occurring in small deposits and in few localities. Within the last forty or fifty years, large deposits of some of these minerals—notably monazite—had been discovered; and certain of the rare earths were obtained in quantities for which no adequate outlet had yet been discovered. The most valuable was thoria; but in monazite, which contains 5 to 10 p.ct. of thorium oxide, it is associated with 60 p.ct. of the cerite group of oxides, consisting chiefly of the oxides of cerium, lanthenum, præsodymium, neodymium, and a small proportion of yttrium.

In Travancore and Brazil, where the largest deposits occurred, the hinterland of the present high-water level was sandy, and contained monazite. The Company with whom the author was associated, Messrs. Hopkin and Williams (Travancore), Ltd., were at present working in the hinterland. Monazite occurred in roundish translucent yellow grains, which could be easily distinguished, and the percentage composition approximately estimated, by means of a hand lens. The raw sand was subjected to a simple sluicing treatment, which removed soil and a large proportion of the quartz; the resulting washed sand being composed chiefly of ilmenite, with 10 to 15 p.ct. of monazite and zircon. The washed sand was next dried in a barbicue in the sun in favourable weather, or on iron plates in a furnace in wet weather. It was sifted to remove all the coarse grains, none of which were monazite, and was then passed through an electro-magnetic separator. Monazite was essentially a phosphate of the rare earths; and this mineral had in recent years constituted the source of thorium for the manufacture of incandescent gas-mantles.

**Midland Juniors and the Education Scheme.**—There is to be a special meeting of the Midland Junior Gas Association in the Council House, Birmingham, to-morrow (Thursday), at which Mr. Walter Hole will give full particulars of the new education scheme.

**Society of Chemical Industry.**—This week the Society of Chemical Industry are holding their annual meeting in Cambridge under the Presidency of Dr. E. Frankland Armstrong, F.R.S., who will deliver his address to-morrow (Thursday). On Friday the proceedings in the Arts School will open with a gratifying function—the presentation of the Society's medal to Dr. Charles Carpenter, C.B.E., who will give an address. On the social side, the programme is an attractive one.

## PERSONAL.

The Burnley Gas Committee have appointed Mr. ALEX. B. MUNROE, who has been with the Glasgow Corporation Gas Department for the past fifteen years, as Manager of their showroom. There were ninety-two applicants for the post.

The Gas Committee of the Manchester Corporation, at their meeting last Friday, appointed Mr. J. H. SILLITOE to the position of Secretary of the department, recently rendered vacant by the resignation of Mr. Godfrey W. Kaye (who has taken up another position with one of the leading ship-owning firms in the city). The appointment is, of course, subject to confirmation by the City Council. Mr. Sillitoe has been in the service of the Gas Department for 23 years—since May 7, 1900—and for the last three years he has been Assistant Secretary. For the first twelve years of his service he held junior positions in various sections of the department. Then, for six years, he was Chief Assistant in the Statistical Office. Afterwards, for two years, he was second assistant to the late Mr. Price, who was Superintendent of the department. On Mr. Price's death, the position was changed to that of Secretary, and Mr. Sillitoe became Assistant Secretary. It will be seen, therefore, that he is thoroughly conversant with the duties of his office. But apart from the knowledge he has acquired by service with the Gas Department, Mr. Sillitoe has not been slow to fit himself for high positions in other ways. He is an Associate of the Chartered Institute of Secretaries (by examination), and has distinguished himself further, in the subject of economics, by passing first class in the examination of the Royal Society of Arts, and by securing other honours from the London Chamber of Commerce and the Lancashire and Cheshire Institutes. For four years Mr. Sillitoe has been Hon. Secretary to the North-Western District of the National Gas Council, and for three years has held a like position in the Manchester (Lancashire and Cheshire) Joint Industrial Gas Council. He is also Chairman of the Manchester District Salesmen's Circle, and a member of the Manchester District Institution of Gas Engineers. We wish Mr. Sillitoe success in his new sphere of work.

## OBITUARY.

### JAMES ROBB.

At the meeting to-day of the Wales and Monmouthshire District Institution of Gas Engineers and Managers, the familiar face of one dear friend and earnest worker will be sadly missed. We refer to Mr. James Robb, Managing-Director of the Chepstow Gas Company, whose sudden death, following a severe heart attack, on the morning of last Sunday week it is our sorrow to have to record. Had he lived another day, he would have been associated with the Chepstow Company for seventeen years. Mr. Robb, who was 65 years of age, was a native of Perth. After spending some years at Limavady, in Ireland, he had charge of the Cinderford Gas-Works, leaving there to go to Chepstow.

The undertaking of which he so long had charge in his beautiful little town was well administered by Mr. Robb, with his son Jack as Assistant Manager; and the consumers enjoy the advantages of a comparatively cheap supply of gas. But his work was not confined to Chepstow. He was all along an active member of the Wales Institution, to the Presidential Chair of which he was elected in October, 1921; and on that occasion Mr. J. H. Canning, of Newport, referred to our friend's technical ability and commercial aptitude, but more particularly to his genial, winning, and intensely human personality, in terms which met with the unanimous approval of the meeting.

Mr. Robb was appointed delegate of the Wales Institution, for the year commencing June, 1922, on the Council of the Institution of Gas Engineers, both of which organizations were represented by Mr. J. H. Canning at the funeral in Chepstow Cemetery last Wednesday. The deceased leaves a widow and several grown-up sons and daughters; and with them much sympathy will be felt in their bereavement.

**Sulphate of Ammonia Exports.**—The exports of sulphate of ammonia last month amounted to 21,476 tons, compared with 4725 tons in May, 1922. In the first five months of this year, 99,495 tons were shipped, as against 55,149 tons in the corresponding period of last year.

**The Southern Association at Plymouth.**—What, in view of previous references to the matter which have appeared in the "JOURNAL," was obviously a slip, unfortunately occurred in our report on p. 665 of remarks made at the luncheon given by the Directors of the Plymouth and Stonehouse Gas Company to the Southern Association of Gas Engineers and Managers. By this slip, Mr. J. M. Campbell, of Margate, had attributed to him the word "daughter"—which he did not use. What Mr. Campbell really did was to unite the Association with words of sympathy uttered by the Mayor in regard to the severe trial through which Mr. Ellis, his son Major Ellis, and his grand-daughter have recently passed. This sympathy was felt far beyond the confines of the Southern Association when the terrible news reached England some two months ago that Mr. Ellis's daughter-in-law had been brutally murdered on the Indian frontier, and his grand-daughter kidnapped. Happily Miss Mollie Ellis was rescued uninjured, and is now at home with her father and grandfather.

## ELECTRICITY SUPPLY MEMORANDA.

IN their own interests, we think that some of our electrical contemporaries might exercise a little common sense when dealing with matters affecting gas. We were writing, in our issue of the 6th inst., of the futility of certain comparisons that are electrically made when treating of respective costs by not quoting the factors that bear upon the matter, to hide the fact that inequality of these factors vitiates the figures. The "Electrician" discloses a serious inappreciation of data in a paragraph it has published headed "Is Gas Deteriorating?" Apparently our contemporary needs educating in the meaning of data, as possibly those of its technical readers who have perused the editorial paragraph will have already concluded. Our contemporary says that Mr. F. W. Goodenough, in discussing certain statements recently made, said that "20 units do the same practical work as one therm" in gas. The writer proceeds to remark that electrical engineers will be interested to gather from such a source either that the thermal value of electricity is increasing, or that that of gas is decreasing. This is stupid. The thermal value of electricity is a definite quantity; that of gas must always be above the declared value per cubic foot in order to allow a margin to avoid penalty, so that the consumer when he pays for a therm gets a portion of potential energy in excess. A little while ago, the "Electrician" says, the ratio put forward by gas men was 29 units to the therm; and now it is evidently 20 units! Of course, the whole of the confusion in the mind of our contemporary is caused by the failure (intentional or otherwise) to appreciate that the 29 units is based upon the potential energy supplied, while the 20 units make a generous allowance for difference in efficiencies. Mr. Goodenough made this clear when he said that 20 units would do the same "practical" work as a therm. Of course, this depends upon the nature of the work. He has evidently given the figure as a comprehensive one to cover all purposes. Twenty units of electrical energy would be equal to 68,400 B.Th.U.; and, according to the statement, 100,000 B.Th.U. supplied by gas would have to be expended to secure an equality of work. This would mean that the gas would have an efficiency (assuming 100 p.ct. efficiency for all purposes for electricity) of 68·4 p.ct. spread over all domestic heating purposes. Now, efficiencies vary for different purposes, both in respect of electricity and gas. No one with any knowledge of the science of heat would admit that for all uses electricity renders an efficiency of 100 p.ct. Considering the hotplates of electric-ovens—when the elements are new they will only give 40 to 45 p.ct. efficiency. A modern gas boiling-ring will give 60 p.ct., and the latest types even more. Then for this purpose, which would be the cheaper, a therm supplied electrically or by gas? Again, take a gas-fire giving 75 p.ct. efficiency (radiant and convected heat), is it better to pay for the therm in the form of gas, or for the electrical units—some 22—necessary to give (at 100 p.ct. efficiency!) 75,000 B.Th.U. to a room? Which would our contemporary rather do—pay for a therm of gas to do the work, or 20 to 22 units of electricity? It all resolves itself into a question of cost to the consumer to render equal duty. It is not gas that is deteriorating; we are being forced to the opinion that it is something else.

**The Interpretation of Data.**

**What is "Being Up-to-Date?"**

Judging from an editorial paragraph in another issue of the same paper, Messrs. Lyons & Co., with their gigantic knowledge and experience in catering, do not know their own business. We incline very steeply to the view that Messrs. Lyons are in a better position to judge than the writer in the "Electrician" whether gas, electricity, or coal suits best their extensive culinary operations. The idea that the latter should in any way challenge the former in this respect is too grotesque. However, it will do just about as much harm as throwing a pebble at one of the pyramids in Egypt. It is Lyons' New Corner House—which is capable of seating 4500 diners at one time, and probably has 30,000 people in it during a day—that has caused our contemporary to question whether Messrs. Lyons & Co. are up-to-date in adopting gas and not electricity for cooking. We may trust that Company for knowing fully and precisely what are the respective merits of gas and electricity for their purposes. They have not been in business all this time, and engaged in unrivalled enterprise in this direction, without being fully informed on one of the most vital parts of their operations. "Gas," remarks our contemporary, "may be the fuel of the present, but we can hazard a shrewd guess as to what the fuel of the future will be." Is that "shrewd" guess based on the conditions that exist at present, and as far as human vision can penetrate? If so, then the "guess" must be that gas will be the fuel of the future, and not a commodity which claims such a large expenditure of heat, in order to produce a quantity equal to a small proportion only of that expenditure. There is something remarkably humorous in the sentence that follows: "To be up to date in the true, rather than in the literal, meaning of the term means to be in front of, and not among, the common ruck." Then a little later, it is said: "To-day, it is up to date to use electricity for cooking." The reason why is not stated. Let us examine our contemporary's contention. In the first place, it is not being up-to-date to be foolish and uneconomical. Public electricity

supply is now more than forty years old. The electricity supply industry has been urging people to cook by electricity for twenty to thirty years past. All sorts of schemes have been put forward to induce them to do this. Long before the war, there were the "Point Fives" hard at work. Amazingly contrived tariffs have also been brought to bear in the effort to coax householders to electrical operation for cooking and heating. Nevertheless, the "common ruck" (which means the major part of the householders of the country) use gas for cooking. Apparently, for very good reasons, it is up-to-date to use a commodity for the purpose that is cheaper and more reliable than electricity, and which, all things considered, is a greater saver of labour, inasmuch as there is little in gas appliances to get out of order. It is a retrograde step to abandon one thing for another which is less economical and reliable. To do this is not being up-to-date. We are content to accept the verdict of Messrs. Lyons & Co. rather than that of a writer in the "Electrician." We would rather accept, too, the public verdict than his, after the strenuous efforts of the electricity industry for many years past.

**The Difficult Water-Heating Problem.**

We return to the issue of our contemporary, in which it is asked whether gas is deteriorating. In that there is another editorial note, headed "Electric Hot Water." "Electrically Heated Water" would have been better. The writer says:

> Gas engineers would no doubt be able to prove by means of the statistics that they have at their fingers' end that for practically every reason gas would be better than electricity for this purpose. Yet gas as a means of providing hot water in the home cannot be called an unqualified success. The apparatus is costly and cumbersome; the ventilation must be properly looked after, if disaster is to be avoided; and the vents may be a constant source of draughts. Gas is burning at the by-pass when it is not being usefully employed; and even when the geyser is at work, a large number of therms go in heating up metal, which heat is not communicated to the water. Matches are required; and the whole procedure which has to be gone through is not to be recommended either to the nervous or the careless.

The writer manifestly thinks he is better at destructive criticism than constructive suggestion. This rigmarole is not particularly flattering to gas as a water-heating agent. However, the enormous number of gas-heated water appliances in use in the country must be a very good index to the remarkably few nervous and careless people who are about; and the experience of the people who have gas-heated water appliances is the recommendation that maintains the flow of orders to gas undertakings to make installations in other houses. The attempt of the writer to back-water with his little oar will not counteract that flow. Experience is a more potent propagandist than words. In view of this, it is not worth while dealing with the fatuous views of our contemporary, of which perhaps the most weighty one is that "matches are required." How horrible! They are also needed by smokers; and they are used by many electricians for various purposes. Householders employ them for lighting candles or oil lamps when electric light collapses. We should not be surprised to learn that even boilers have been lighted-up at electricity stations by matches. But after all its criticism, our contemporary cannot say that electricity can supply the domestic needs for hot water better than gas. In fact, he says: "The problem is not an easy one; but electrical engineers have solved even more difficult matters." We do not know of one that has been "more difficult." We challenge this writer of peculiar argument on this matter, to show that he can heat water more cheaply and quickly, with large variations in demand and supply, by any electrical method than can be accomplished by gas. There is no method that can respond to varied domestic demand with the same promptness as gas.

**Putting All One's Eggs into One Basket.**

The aphorism which tells us of the folly of putting all one's eggs into one basket, should be duly weighed by the electricity industry in connection with the question of super-power stations. It does not matter one jot to the gas industry whether the competing industry goes in for super-power stations, or adheres to the practice of the local generating station; for so far as one can see, on balance the super-power station has not in it the capacity to produce much more economy than the local station with a good diversity of demand upon it so as to deliver current at an appreciably cheaper rate at the consumers' terminals. But electricity being in competition with gas, the industry supplying the latter is interested in what the industry supplying the former is doing, or is proposing to do. The super-station is merely an accumulation of units of generating plant; and the concentration has its dangers for the consumers, and a greater number of them, than in the case of separate stations in each locality—not only in times of war, but in times of peace. There have been explosions of turbines and a shattering of plant which have placed local generating stations out of action; there have been fires which have disabled plants; and the aggregate of loss and inconvenience to the consumers has been great. A correspondent of "The Times" gives an account of a serious fire that occurred on June 4 at the power station of the Calcutta Electric Supply Corporation, which put something like 30,000 H.P. of plant out of commission. Many factories and workshops had to close down, and some districts were also deprived of lighting supply. The cause of the fire is stated to have been the burning-out of the stator of an old generator, which deranged certain of the auxiliaries. It is true that a partial supply was renewed in a few hours; but in a few hours a tremendous loss can be occasioned to factory owners, workers, and others. The larger the station, and the greater the area of supply from the one station, the more considerable the risk.

**Tenants' Wiring and Landlords' Rights.**

Reference was made in the "Memoranda" last week to the question of the wiring of houses by tenants, and as to how they would stand in respect of the value of the wiring should they desire to leave the house. This is where the danger comes in of making wiring installations on easy-payment terms spread over a period of years, inasmuch as, on a tenant leaving the house, the wiring, being fixed to the premises, would automatically become the property of the landlord. Yet a contributor to the "Electrical Review" was suggesting the other day that landlords should compensate tenants who had "improved" their property, but were giving up their tenancies. We suggested that landlords who have certain legal rights were not likely to take this philanthropic view. A legal contributor to the "Electrical Review" has written an interesting article on the subject; and he presents a number of typical cases, and supplies an opinion upon them. We venture (with this acknowledgment) to make a few extracts. In the first place, the legal contributor puts the case of a tenant who wires a house which he holds under a lease of years. Do the wires vest in the landlord at the end of the term? He submits that in this case the wires and the casing of the wires vest in the landlord, and could not be removed by the tenant unless pursuant to special powers conferred upon him by his lease. A tenant would be liable if he attempted to remove the wires. The next case he considers is that of a landlord who wires a new house, and the tenant puts in switches, distribution-boards, and lamp brackets. Can he remove these at the end of his tenancy? With regard to the switches and distribution-boards, it appears to him that these fall within the category of articles which are of a permanent character, and would have to be used in practically the same form in relation to any installation. At any rate, he would be sorry to advise a tenant to remove them, only to leave blank spaces on the wall to which they were affixed. With regard to lamp brackets, these fall within a different category. They can generally be removed without doing damage. In these circumstances, it seems to be clear that they are the tenant's property, which he can remove at will. The next case is that of a tenant who puts in a transformer at his own cost. Does the transformer vest in the landlord? It could be easily detached, and must, in the contributor's view, be treated as a tenant's fixture, which he can remove. Another case is that of a tenant who puts in ceiling-roses, made of metal or porcelain, and wall sockets. Do any of these belong to the landlord? Ceiling-roses, he says, appear to be very much on the border line; but it would seem that, inasmuch as they are generally ornamental objects, they should be treated as tenant's fixtures. As to a wall socket, it is thought that this would be a tenant's fixture, as it might easily be removed, and replaced by a permanent connection to a wall or bracket lamp. The final case assumes a tenant installing electric light throughout a house; and the question is asked, Can any action be brought against him by his landlord, if on finding that the landlord refuses to pay anything towards it, he deliberately cuts or damages the wires without defacing the decorations? The opinion is that, if a tenant does any damage, whether by removing landlord's fixtures, or improperly removing his own, he can be held liable to make it good. The ordinary covenant to leave in repair, clearly imposes such liability.

## Oxy-Acetylene Equipment for Gas Undertakings.

The use of oxy-acetylene equipment in connection with gas undertakings was dealt with by Mr. E. E. Lungren, of the Western United Gas and Electric Company, at the annual convention in Chicago of the International Acetylene Association. Attention was drawn by him to the wide outlet that the gas industry provides for welding material. The adoption of the practice of welding steel pipe has, he said, reached such a stage that it is no longer experimental; and there are certain very definite reasons why it has the advantage over other methods. His own Company have welded all their pipe-lines for the past seven years. From the experience thus gained, they are able to enumerate as the outstanding advantages of welded joints reduction in leakage, increased strength of the lines, lower cost, and more rapid progress in construction work. The welded joint, when properly made, is as impervious to leaks as the pipe itself; and when found to be perfect on its original test, the Company are positively assured that no leaks will develop in service. This statement is substantiated by their experience with 172 miles of welded pipe-lines, ranging in size from 1¼ in. to 12 in., the greater part of which are carrying gas at high pressures. These lines have been in service from one to seven years, and there has been practically no maintenance work on any of them. All cast-iron fittings can be eliminated, since the welder can make any kind of fitting that is required. By the use of extra heavy flanged steel valves, with welded companion flanges, which have as great strength as the pipe itself, the Company obviate the necessity for expansion joints, and the line becomes practically one solid piece of steel.

## NATIONAL GAS COUNCIL.

### Meeting of the Central Executive Board.

The Central Executive Board of the National Gas Council met at No. 30, Grosvenor Gardens, S.W., on the 12th inst.—Mr. D. MILNE WATSON in the Chair.

NOMINATION OF CANDIDATE FOR THE OFFICE OF PRESIDENT.

It was reported that no nominations had been received for the office of President. Mr. D. Milne Watson was thereupon unanimously nominated candidate for the post for another year.

REDUCTION OF CARBON MONOXIDE CONTENT—TULLY PROCESS.

It was reported that the Council had already dealt with this matter in their report for the month of May. It was added that the Council had arranged for an inspection and report to be made as soon as a plant was known to be actually in operation demonstrating Mr. Tully's new process.

DRAFT MODEL BYE-LAWS FOR THE PREVENTION OF WASTE, CONTAMINATION, OR MISUSE OF WATER.

A conference was reported of representatives of the Gas Appliances Specification Committee of the Council (to whom this matter was previously referred by the Central Executive Board) and representatives of the British Water-Works Association, on May 11, with a view to the amendment of the draft model bye-laws and specification in connection with the fixing and use of gas-heated installations. It was suggested at this conference that local conferences should take place between gas engineers and representatives of the local water authorities, and that a Joint Reference Committee should be formed in London consisting of representatives of the Council and of the British Water-Works Association, to which any dispute that could not be settled locally should be referred. It was agreed by the Central Executive Board that if—as seemed probable—the drafting of the model bye-laws could be amended as suggested by the Council's representatives, the National Gas Council might consider withdrawing the objections which they have already lodged with the Ministry of Health.

COKE.

It was reported that the Manchester District Executive Board had forwarded to the Council a report of the Commercial Section of the Manchester District Institution of Gas Engineers with regard to coke sales, which, after consideration, they had approved. This report had been circulated among members of the Central Executive Board for their consideration. It was reported that the arrangements come to in the Manchester area had met with great success. It was decided to draw the attention of the other District Executive Boards of the Council to the arrangements for the disposal of coke in the Manchester area, in order that the scheme might be considered by each district having regard to the local circumstances, which obviously varied in different parts of the country.

STANDARD COOKER.

Mr. R. J. Rogers, the Chairman of the Gas Appliances Specification Sub-Committee of the Council, submitted a report upon the work accomplished by the Sub-Committee in connection with the standard cooker, models of which were on view for the inspection of those present. A hearty vote of thanks was unanimously passed to the Gas Appliances Specification Committee of the Council for their valuable assistance, and in particular to Mr. R. J. Rogers and the Sub-Committee, who had devoted so much time and consideration to designing the standard cooker.

## LOW-TEMPERATURE CARBONIZATION OF BITUMINOUS COAL.*

Reviewed by G. M. GILL.

To those interested in the subject of low-temperature carbonization this book by M'Culloch and Simpkin should appeal. It gives a fairly comprehensive, but by no means full, description of all the best-known low-temperature systems. The modest size of the book, containing 248 pages, would, of course, render this impossible; but anyone wishing to know the present extent of the work done and progress made in this, to many people, fascinating subject, could not do better than peruse this work.

The book consists of seven chapters, dealing first, as is also the case with the preface, with the economic and hygienic disadvantages of the existing methods of burning raw coal, with its attendant smoke production. All concerned with gas undertakings will heartily support the authors in their plea for the long overdue improvement in the condition of the atmosphere, especially in all industrial towns. Some gas engineers, however, may disagree with the authors in the methods which are most likely to bring about this much-needed reform.

This problem of carbonizing coal at low temperatures must always strike those with considerable experience of carbonization as an exceedingly difficult proposition, though it would take a bold man to prophesy that these difficulties will not be surmounted. The advocates of low-temperature carbonization lay much stress on the need for producing a free-burning coke and a large quantity of fuel oil; and no one can gainsay the fact that both these are badly wanted in this country. As regards the first-named product, there is, however, quite a good prospect of a high-temperature process producing a free burning, and otherwise commercially successful, smokeless solid fuel. Practically everybody having any acquaintance with this subject has jumped to the conclusion that the free-burning qualities of coke or coalite have depended upon the percentage of volatile content in the fuel, disregarding all the other important factors, the sum of which are indeed of greater significance than the proportion of volatile matter left in the fuel after carbonization.

With wholly or partially carbonized fuel there are the following factors influencing both its degree of combustibility and the satisfaction which will be given to the user.

(1) Percentage of ash, and its character.
(2) Percentage of moisture.
(3) Size of the fuel and its uniformity, and the suitability of size for the appliance in which the fuel is to be used, and the purpose for which it is intended.
(4) The porosity of the fuel, and the number, distribution, and size of the air cells contained therein.
(5) Volatile content.
(6) Freedom from dust.
(7) Mechanical strength of the fuel and its suitability for the inevitable rough handling to which it is bound to be subjected during transportation.

It would, therefore, seem that the gas industry must either itself tackle the question of the production of a really suitable coke, or it must be content to watch another industry undertaking this work, although it must be obvious to all thinking men that the gas industry has many advantages over any new industry in solving this problem. Let the industry, therefore, encourage and assist all true workers in this branch of fuel production. It must be admitted that all is not well with the coke sold to-day. Much of it is deficient in the properties that are essential if satisfaction is to be given to the user.

In Chapter III. is traced the history of low-temperature carbonization, for the introduction of which some credit is given to W. D. Scott Moncrieff, and later to Thomas Parker, the inventor of coalite. Parker took out his first patent in 1890; but it was not until 1906 that the Coalite Company was formed. It is also recorded that the Glasgow Corporation decided, in May, 1914, to give a trial to some low-temperature carbonizing process; and their choice fell upon the Maclaurin system. It is to be hoped that the results of their experiments will be published in due course.

Carbonization at low temperatures received a great fillip during the war as a result of the determination of the Ministry of Munitions to do everything possible to facilitate the production of oil, large quantities of which were required for many essential purposes. In spite of this encouragement very little oil was produced by any low-temperature process.

In Chapter IV. the authors deal with the necessary characteristics of low-temperature coke and the difficulties encountered in its preparation. Reference is also made to the many uses for fuel of this description. In Chapter V. the various low-temperature processes are described in some detail; but it is noticed that while the coalite process which has been working at Barnsley for some time past is described and illustrated, the new vertical-retort system to be introduced in connection with the Tully plant is not mentioned. Gas engineers will await with a good deal of interest the publication of the details of the new type of plant. The combination of high and low grade gas thus associated in one plant will in itself dispose of the most serious drawback always associated in the past with the adoption of any type of low-temperature process. The perusal of this chapter will impress the reader with the large amount of work which has been done in connection with low-temperature carbonization.

In Chapter VI. the authors discuss the composition of coal tar, as produced by different systems; while in Chapter VII. the subject of low-temperature tar is discussed at some length. Much useful information is contained in this chapter.

In Appendix I. are given details of the various specifications affecting the liquid products obtained from the low-temperature carbonization of coal; while in Appendix II. the structure of coke and its effect on the combustibility of the fuel is discussed in a very interesting manner. The work now being done by Sir George Beilby, Sutcliffe and Evans, and Greenwood and Cobb, referred to by the authors, is undoubtedly going to have a great effect on the attention given to the physical characteristics of coke, whether it be the product of high or low temperature carbonization. Great scope exists for an improved gas-works coke; and, if for no other reason, gas engineers should familiarize themselves with the methods employed not only in coke-oven circles, but also by low-temperature carbonizing workers, and so be ready to adopt new developments likely to be of advantage in gas-works.

* "Low-Temperature Carbonization of Bituminous Coal," by M'Culloch and Simpkin. Messrs. H. F. & G. Witherby, London. Price 18s. net.

**Southern Association of Gas Engineers and Managers (Western District).**—The next meeting of the Western District of the Association will be held in the offices of the Exeter Gas Company on Friday, July 13, at 2.30.

# CORROSION IN GAS-MAINS AND METERS.

By H. E. WILLIAMS, of Manchester.

ATTENTION has recently been directed to the serious corrosion that is taking place in gas-mains and service pipes, and on the metal parts of meters.

This question was considered by a Joint Committee on the "Life of Gas-Meters;" and a report of their findings was duly published by Mr. J. G. Taplay, Chemist to the Committee [see "JOURNAL" for June 3, 1919, p. 622]. The chief conclusion arrived at in this report was that the hydrocyanic acid in the gas was the chief cause of the corrosion. No experimental evidence was given in support of this contention, which appeared to be based on hypothetical considerations at variance with the known general chemistry of the reagents in question.

The true nature of the corrosion has, however, been recently described by Mr. B. Richardson in a very able paper [see "JOURNAL" for May 9, 1923, p. 348], in which he has shown that the main cause of the corrosion is due to the alternate action of carbon dioxide and oxygen in the presence of water; the blue iron cyanogen compounds found in the deposit being produced by the scrubbing action of the hydrated oxides of iron, formed as a product of the above corrosive action, on the trace of hydrocyanic acid in the gas. This explanation of the cause of the corrosion of the service pipes was also clearly stated by Mr. M'Leod of Greenock [see "JOURNAL" for June 20, 1911, p. 903].

The corrosion of iron by coal gas is a question of considerable interest to the gas world; and it is of importance that the true nature of the corrosion and the relative influence of each corrosive agent should be established by direct experimental proof.

The writer's attention was called to this question about six months ago; and with the object of opening-up this view, a number of experiments were devised to demonstrate the true cause of the corrosive action of the gas. In these experiments the gas, maintained in a moist condition, was allowed to pass slowly, at the rate of about 5 c.ft. per hour, over iron "wool" placed in a U tube.

EXPERIMENT NO. 1.

The coal gas, kept moist by passing through a tower packed with wet cotton wool, was conducted through a U tube packed with fine iron wool. The iron wool was rapidly corroded in a few days; thus demonstrating the corrosive activity of the gas.

EXPERIMENT NO. 2.

The gas was passed through a glass absorption tower packed with sawdust moistened with sodium cyanide solution, then through a U tube containing fine iron wool. The gas, after passing this tube, was next led through a second tower packed with sawdust moistened with a paste of nickel carbonate and sodium carbonate, and then into another tube of fine iron wool.

The gas in passing the first tower is scrubbed free from carbon dioxide by the sodium cyanide; the whole of the carbon dioxide being replaced by hydrocyanic acid (prussic acid) thus:

$$2NaCN + CO_2 + H_2O = Na_2CO_3 + 2HCN.$$

In passing the first U tube of iron wool this gas caused no corrosion whatever, showing that the corrosion was not due to the hydrocyanic acid, and also, that it would not take place when the carbon dioxide was removed.

The gas from the U tube, on passing into the second tower, has all the hydrocyanic acid content removed by the action of the carbonates of nickel and sodium; the hydrocyanic acid being replaced by carbon dioxide, thus:

$$4HCN + Na_2CO_3 + NiCO_3 = Na_2Ni(CN)_4 + 2H_2O + 2CO_2.$$

This gas, on passing the second U tube of iron wool, caused very rapid corrosion.

This experiment clearly demonstrated that the corrosive action was due to the carbon dioxide in the gas, and not to hydrocyanic acid, for whereas when the carbon dioxide was removed and an equivalent quantity of hydrocyanic acid liberated no corrosion took place in the first tube of iron wool, yet considerable corrosion resulted in the second tube, on the same gas stream, when the hydrocyanic acid was absorbed and an equivalent quantity of carbon dioxide liberated.

EXPERIMENT NO. 3.

The gas was divided into two streams, one of which was passed through a tower packed with sawdust wetted with sodium cyanide solution, to remove the carbon dioxide and liberate hydrocyanic acid, and then joined to the main stream and passed through a U tube containing iron wool.

The object of passing a portion of the gas through the sodium cyanide tower was to increase the hydrocyanic acid content while removing only a portion of the carbon dioxide, so that the iron wool could be acted upon by carbon dioxide and hydrocyanic acid simultaneously. The iron wool was rapidly corroded, and finally turned blue. The carbon dioxide in the gas attacked the iron, forming ferrous carbonate, which was partly oxidized to ferric hydroxide by the action of the small quantity of oxygen in the gas, and partly converted into ferrocyanides of iron by the hydrocyanic acid.

From the experiments described above, it is very clearly demonstrated that the corrosive action of the gas on the iron service pipes and frames of the meters is chiefly caused by the carbon dioxide and moisture present in the gas; this action being very greatly accelerated by the oxygen also present. The ferrous carbonate first formed is oxidized to ferrosoferric and ferric hydroxide with liberation of carbon dioxide for further destructive action.

The corrosive action of the hydrocyanic acid on the iron, even when artificially increased in the gas to an amount equivalent to the carbon dioxide normally present, is not detectable. These results, taken in conjunction with the fact that in modern gas the carbon dioxide content averages 2 p.ct. or over and the hydrocyanic acid not more than a few grains per 100 c.ft., show that the latter may be ruled out as a direct corrosive agent.

The presence of iron cyanogen compounds in the corrosive deposits found in the service pipes and mains is, of course, easily accounted for. This deposit, which contains ferrous carbonate and hydroxide and occasionally sulphide, forms a most effective absorber for the hydrocyanic acid in the gas, particularly in the presence of ammonia. The small quantity of iron sulphide sometimes found in the fresh deposit is also readily understood once the action of the carbon dioxide, moisture, and oxygen has started, for the accumulating deposit of iron hydroxide will act equally well as an absorber for the small traces of hydrogen sulphide that may occasionally pass as for hydrocyanic acid forming iron sulphides, which are partially oxidized, giving rise to free sulphur. In thus removing the hydrogen sulphide and hydrocyanic acid, these deposits fulfil the same function as the iron oxides in the purifying boxes. The corrosive action, when once started at any particular centre, will cause an accumulation of deposit of iron hydroxide, which, with its increased surface, will act as a centre of condensation for water vapour, and thus not only keep the local iron surface moist—a most dangerous condition—but will more and more effectually scrub the deleterious impurities out of the gas.

If at any time undue amounts of hydrogen sulphide pass into the main, ammonium thiocyanate is liable to be formed by interaction of this gas with ammonia, hydrocyanic acid, and sulphur, thus:

(1) $H_2S + 2NH_3 + S = (NH_4)2S_2$

(2) $(NH_4)2S_2 + HCN = NH_4CNS + NH_4HS,$

or by interaction with ammonia and carbon bisulphide,

$$H_2S + 2NH_3 + CS_2 = (NH_4)_2CS_3$$

the thiocarbonate then breaking down on long standing, forming ammonium thiocyanate—

$$(NH_4)_2CS_3 = NH_4CNS + {}_2H_2S.$$

Ammonium thiocyanate thus formed on the surface of the deposit would tend to accelerate the corrosive action of the carbon dioxide. As the amount of ammonium thiocyanate in these deposits is directly dependent on the presence of hydrogen sulphide in the gas, the amount formed in good works practice would be too small to need serious consideration.

That carbon dioxide and oxygen in presence of water should corrode the iron surface of the gas-mains and meters is not surprising in view of the fact that these agents are the chief cause of the rusting of iron when exposed to moist air and to the action of water containing carbon dioxide and oxygen in solution.

In the report of the Committee, the analyses of a number of samples of corrosive deposits obtained from the service pipes are given, which, it is stated, confirm the conclusion given in that report. These analyses are capable of another interpretation, as shown above—once more in accordance with the known general chemistry and properties of the reacting principles of the gas. The formation of blue iron cyanogen compounds in these deposits results from the interaction of hydrocyanic acid and ammonia on the products of corrosion (ferrous hydroxide and carbonate), and plays no part in the corrosive action.

The interest in this question centres on the direct action of the various reagents on the metallic iron, causing corrosion. What happens to the products of corrosion, or what reactions take place between them and other constituents of the gas, has no bearing on the question at issue, and is only of academic interest. The increase of corrosion which has taken place in recent years is, in the light of the experiments described, easily accounted for. In modern gas practice a much larger proportion of carbon dioxide and oxygen is present in the gas than formerly, owing to the growing use of blue water gas and the practice of revivifying the oxide boxes *in situ*; the former practice increasing the carbon dioxide content, and the latter the oxygen. Carbon dioxide may be removed by passing the gas through purifiers containing slaked lime; and in the past the use of this purifying material was common. Of late years, however, this method of purification has been abandoned; and, except for a small amount removed by the ammonia scrubber, the whole of the carbon dioxide content of the original gas passes into the service mains. The carbon dioxide content of the gas is, of course, very much greater with the use of an admixture of blue water gas than with straight coal gas.

In the report of the Chief Chemist of the Life of Gas-Meters Committee it is stated:

"The fact that many of the cases reported as having oc-

curred since oxide alone has been used in the purifiers, is of interest, for the following reasons:

(1) Absence of lime in purification accounts for the passing forward of the bulk of the hydrocyanic acid found in the gas."

It is found, however, in general practice, that the bulk of the hydrocyanic acid in the crude gas is stopped by the oxide purifiers; but the whole of the carbon dioxide present in the gas—formerly completely absorbed by the lime—passes unchanged through the oxide boxes.

There can also be very little doubt that with the decrease of the illuminating power of the gas a considerable protective effect—due to the condensation of tarry matter and heavy hydrocarbons on the internal surfaces of the service pipes and mains—has been lost. With the loss of this protective covering, the iron is much more exposed to the corrosive action of the gas; and when this fact is taken into consideration, in conjunction with the increase of the corrosive constituents (carbon dioxide and oxygen), it is not surprising that corrosion has of recent years become a serious problem.

The author wishes to express his thanks to the Directors of the Manchester Oxide Company for permission to publish the results given above.

## FUEL RESEARCH COMMITTEE.

### Resignation of Sir George Beilby.

The Lord President of the Council has accepted with much regret the resignation of Sir George Beilby, LL.D., F.R.S., after nearly seven years' voluntary service as Director of Fuel Research and Chairman of the Fuel Research Board under the Department of Scientific and Industrial Research. The Board was established in 1917 to investigate the nature, preparation, and utilization of fuels of all kinds.

The Lord President has appointed Mr. C. H. Lander, D.Sc., M.I.Mech.E., A.M.Inst.C.E., to be Director of Fuel Research, and Sir Richard Threlfall, K.B.E., F.R.S., a present member of the Board, to be Chairman. The Hon. Sir Charles Parsons, K.C.B., F.R.S., will continue his membership of the Board for a further period. Sir George Beilby retains his membership of the Advisory Council of the Department, and has consented to act as Honorary Adviser to the Board.

The following gentlemen have accepted appointment as additional members of the Board. Mr. R. A. Burrows, Sir John Cadman, K.C.M.G., D.Sc., Dr. Charles Carpenter, C.B.E., D.Sc., Mr. Samuel Tagg, Prof. Sir James Walker, D.Sc., LL.D., F.R.S., Prof. R. V. Wheeler, D.Sc.

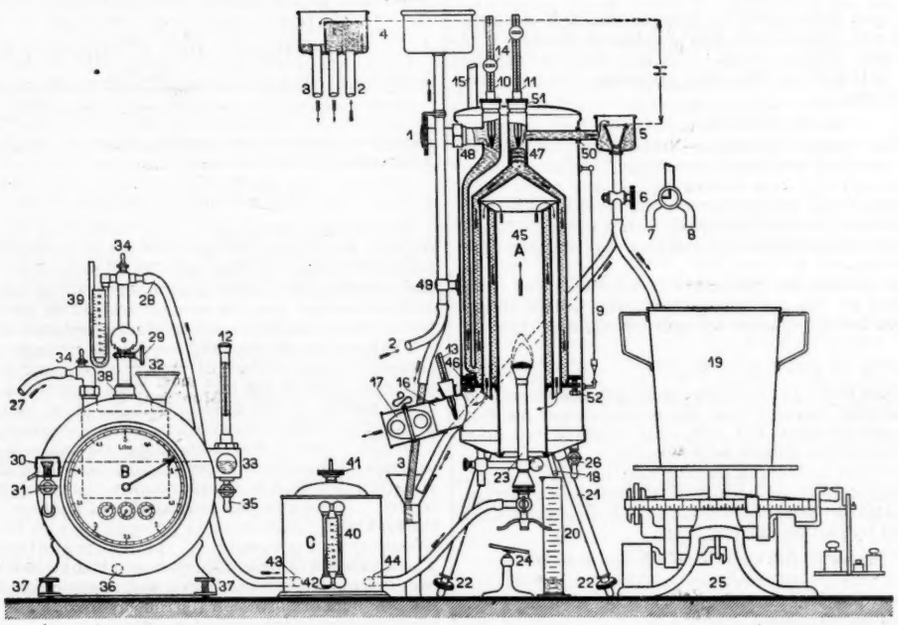
## THE JUNKERS CALORIMETER.

At the present time the question of the calorific value of gas is of the utmost importance; and of the various types of calorimeters which have been discussed and reported on, the "Junkers" flow calorimeter has not, of late, had the attention its undoubted merits deserve.

With the calorimeters hitherto used, the heating value was determined from the increase of temperature of a measured quantity of water enclosed in the apparatus resulting from the burning of a measured amount of the fuel. The present calorimeter, destined especially for testing gases and liquids, works continuously, inasmuch as the combustion takes place continuously (and ordinarily, as in the open air); and, instead of the fixed quantity of water, a constantly flowing jet of water is employed which every moment draws from the instrument as much warmth as the flame produces. The heating value can then be easily determined on the basis of the formula:

$$H = \frac{W \times T}{G}$$

where H is the heating value, W and G the quantities of water and gas, and T the difference in temperature. The measurement of the gas or liquid fuel is done by means of a gas-meter or other convenient contrivance. The method of working in the state of permanency offers great advantages; many sources of errors, corrections, weighings, &c., are dispensed with; and the measuring process is executed rapidly with accuracy and reliability. By collecting the condensation water produced by the combustion of hydrogen and flowing-off at the foot of the calorimeter, the heating value of the combustion products in the state of vapour can be easily determined.




1. Water regulating cock. 2. Cold-water connection. 3. Connection for draining water from overflow. 4. Water overflow arrangement. 5. Warm-water discharge. 6. Distribution discharge. 7. Connection (branch) for measuring water. 8. Connection (branch) for waste water. 9. Plumb line. 10. Thermometer 1/10° C. cold. 11. Thermometer 1/10° C. warm. 12. Thermometer 1/1° C. gas. 13. Thermometer 1/1° C. exhaust gases. 14. Reading-off glasses. 15. Vent pipe. 16. Exhaust gas branch. 17. Throttle valve. 18. Condensation-water branch. 19. Measuring vessel, large. 20. Measuring vessel, small. 21. Legs. 22. Adjusting screws. 23. Burner with foot. 24. Standing mirror. 25. Balance and weights. 26. Drain cock. 27. Gas inlet to meter. 28. Gas outlet from meter. 29. Gas regulating cock. 30. Level overflow. 31. Cock for same. 32. Filling funnel. 33. Box and sight glass. 34. Vent cocks. 35. Drain cock. 36. Draining screws. 37. Adjusting screws. 38. Spirit level. 39. Pressure gauge for gas. 40. Pressure gauge for gas. 41. Loading (pressure adjusting) discs. 42. Draining screws. 43. Gas inlet to pressure regulator. 44. Gas outlet from pressure regulator. 45. Tube heater. 46. Flange bolts. 47. Water mixer. 48. Screw connection to cock 1. 49. Screw to side stay. 50. Screw connection to overflow 5. 51. Thermometer screw connections. 52. Press screws to flange ring.

The illustration shows the details of the latest form of the apparatus, which is being marketed by Engineering Supplies, Ltd., of No. 11, Queen Victoria Street, London, E.C.

**The Carlisle Gas-Works.**—In the issues of "The Engineer" for May 25 and June 1, a description of the new gas-works at Carlisle, together with many excellent illustrations, has appeared. Though it may not be common knowledge, Carlisle claims to have been one of the first towns in the country to use coal gas as an illuminant; the first works being erected in 1820. An account of the new works was given in the "JOURNAL" for Oct. 11, 1922.

# NATIONAL GAS COUNCIL OF GREAT BRITAIN AND IRELAND.

## Fifth Annual General Meeting.

THERE was a good attendance at the Fifth Annual General Meeting of the National Gas Council, which was held on Tuesday afternoon of last week, in the Pillar Hall of the Cannon Street Hotel, E.C.—under the Presidency of Mr. D. MILNE WATSON.

At the opening of the proceedings, the minutes of the fourth annual meeting, having been circulated, were taken as read, confirmed, and signed.

MEMBERS OF THE CENTRAL EXECUTIVE BOARD REPRESENTING DISTRICT EXECUTIVE BOARDS AND ASSOCIATED BODIES.

The SECRETARY (Mr. W. J. Smith) reported the following list of members of the Central Executive Board appointed and nominated respectively by the District Executive Boards and Associated Bodies.

*Eastern District.*—Messrs. Thos. Glover, C.B.E., W. W. Townsend, W. H. Mainwaring, R. G. Shadbolt.
*Ireland.*—Messrs. R. Bruce Anderson, A.M.Inst.C.E., W. J. Grey, A.C.A., J. D. Smith, M.Inst.C.E., Joseph M'Nicholl.
*London District.*—Messrs. Thomas Hardie, M.Inst.C.E., Stanley H. Jones, Frank H. Jones, Archibald Caddick.
*Manchester District.*—Messrs. Samuel Tagg, F. A. Pye, W. J. Smith, G. S. Frith.
*Midland District.*—Messrs. L. E. Clift, J. Paterson, M.A., A. W. Smith, H. Davies.
*Northern District.*—Messrs. Herbert Lees, A.M.Inst.C.E., Norman S. Cox, F. P. Tarratt, T. P. Ridley.
*Scotland.*—Messrs. Laurence Hislop, J. W. Napier, Bailie R. G. Slorach, B.L., Bailie James Stewart.
*Southern District.*—Messrs. Wm. Cash, F.C.A., A. F. Phillips, M.Inst.C.E., C. F. Botley, M.Inst.C.E., H. C. Head, M.Inst.C.E., M.I.Mech.E.
*South Wales.*—Messrs. Geo. Clarry, F.C.I.S., W. Clark Jackson, W. J. Johns, J. Mogford.
*South Western District.*—Messrs. J. H. Ellis, W. N. Westlake, S. J. Ingram, S. E. Halliwell.
*Yorkshire (W. Riding) District.*—Messrs. H. E. Bloor, B.Sc., B.Eng., Chas. Wood, F.C.S., O.B E., Ralph Halkett, Arnold E. Mottram.
*Institution of Gas Engineers.*—Nominations not yet received. Last year's members were: Messrs. J. Ferguson Bell, J. Paterson, J. C. Smith, M.Inst.C.E., Samuel Tagg.
*British Commercial Gas Association.*—Nominations not yet received. Last year's members were: Alderman F. S. Phillips, J.P., Mr. F. W. Goodenough, Mr. D. Milne Watson, Sir Geo. E. Davies, J.P.
*Gas Companies' Protection Association.*—Messrs. H. E. Jones, D. H. Helps, M.Inst.C.E., A. A. Johnston, R. W. Edwards.

## THE REPORT.

The following report was then submitted, together with the statement of accounts, for the twelve months ended March 31 last.

### GAS REGULATION ACT.

*Section* 1.—During the period under review, 84 gas undertakings have lodged application with the Board of Trade for the substitution of a standard or maximum price per therm in lieu of their existing price per 1000 c.ft.; and 117 orders have been made.

*Section* 10 (*Special Orders*).—During the same period, 37 gas undertakings have lodged applications under this section with a view to extending the powers conferred by their Private Acts and obtaining additional powers.

In the case of applications under both these sections, the Council have endeavoured to assist their members in every possible way.

*Sections* 4 *and* 5 (*Testing of Gas*).—Frequent consultations have been held between the Council and the Gas Referees with regard to the Referees' prescriptions for gas testing. The views of the Council received careful consideration by the Referees, who have made certain modifications in their prescriptions, notably in the one for pressure testing, which it is hoped will prevent any friction arising between gas undertakings and gas examiners.

Meetings of the municipal members of the Council have been convened to consider their position under the Act; and a small Committee was formed from such members to safeguard municipal interests.

### THERM CHARGES INQUIRY.

Much work was entailed by the inquiry of the Departmental Committee into the thermal system of charging for gas. The Council played a prominent part in ensuring that the case for the gas industry was properly presented, with the result that the unanimous report of the Committee completely exonerated the industry from the unjustifiable attack made upon it in connection with this matter.

At the termination of the inquiry, the Council were invited by the Board of Trade to a conference to consider if any further methods could be devised, in connection with the distribution of gas, for ensuring the safety of consumers. This important matter is still being considered by a Special Committee of the Council.

### CARBON MONOXIDE.

An extremely virulent Press campaign in connection with the alleged dangers due to the carbon monoxide content in gas has had to be combated during a large portion of the year. Machinery has now been set-up to cope with this question. Watch committees have been formed in the Provinces, and adequate steps have been taken in London and the Home Counties to counter the many unfounded statements that have been made.

### ELECTRICITY (SUPPLY) ACT, 1922.

Owing to the efforts of the Council, the Government agreed, on the report stage, to modify the Bill, as introduced, in favour of the gas industry—in particular in connection with the form of the stand-by clause, and also as to the powers proposed to be given to railway companies to supply electricity direct to individual consumers.

### LONDON ELECTRICITY SUPPLY.—DRAFT SCHEME OF ELECTRICITY COMMISSIONERS.

The Council have been compelled to oppose the above scheme, in order that the interests of the forty-one members of the Council affected might be safeguarded. At the hearing of the inquiry, the Council appeared by Counsel, and objected to the scheme on the ground that the interests of gas undertakings as ratepayers were not sufficiently protected, and also that there was no justification for the clause which enabled the joint electricity authority to lay down gas-mains in the area of a statutory gas undertaking. The inquiry is still proceeding.

### FACTORY AND WORKSHOP ACT, 1901.—CHEMICAL WORKS REGULATIONS, 1922.

Since the issue of these regulations in August last, the Council have made application, on behalf of about 50 undertakings, for a certificate of exemption from either part 1 or part 2, or both, of the regulations. Further, the Council have interviewed the Home Office in connection with this matter, in consequence of which it is felt that sympathetic treatment will be meted out to the gas industry. The efforts of the Council, on behalf of the smaller undertakings in particular, have been much appreciated.

### RAILWAY RATES.—CARRIAGE OF COAL, COKE, &c.

The negotiations carried on with the railway managers by the Council, in conjunction with other traders, for the purpose of obtaining further concessions in connection with the carriage of coal, coke, &c., resulted in further reductions taking place in August last. The Council are still taking advantage of every suitable opportunity that presents itself to press for yet further reductions.

The interests of the gas industry have also been watched on many other important matters—such as general railway classification, exceptional rates, mileage gradations, private-siding agreements, dock dues, and standard terms and conditions of carriage, wagon hire, &c.

The importance to the gas industry of the question of railway rates cannot be over-estimated; and the Council are taking all possible steps to ensure that in this respect the interests of the industry are amply protected.

### FINANCIAL CO-ORDINATION OF VARIOUS DEPARTMENTS OF LOCAL AUTHORITIES.

Cases have from time to time been brought to the notice of the Council of systematic endeavours on the part of a city treasurer, or similar official, to establish a system of financial co-ordination of the various trading departments of a Corporation, by transferring the financial work in connection with such departments to his own control. It was decided to offer the most uncompromising opposition to any such movement; and a Municipal Committee of the Council have been appointed to watch municipal interests in this matter.

Members of the Council have been asked to bring forward any case coming to their notice where it seems likely that the departments under their control will be adversely affected; and steps will at once be taken to combat any effort on the part of a city or borough treasurer to usurp the functions which properly belong to a municipal trading department.

### WORKMEN'S COMPENSATION INSURANCE.

Members continue to avail themselves of the arrangements made by the Council with Lloyd's Underwriters, whereby employers' liability risk can be covered upon special terms. During the past year premiums have been still further reduced. More than 200 gas undertakings have taken out policies; and it is estimated that the aggregate saving effected exceeds £10,000—in some cases the saving effected being equivalent to six times the amount of the subscription paid by the undertaking to the Council.

### STANDARD COOKERS.

A full report of the Gas Appliance Specification Committee of the Council with regard to tenders for patterns and jigs, &c., for the Council's standard cookers, was published in the report for December last. Upon the recommendation of this Committee, the Central Executive Board authorized the acceptance of the tender submitted by the Parkinson Stove Company, Ltd., for the supply of master patterns and jigs. This firm are making excellent progress with the work; and it is anticipated that sample cookers will be available to members during June. As the number of sample cookers will be limited to 200, of which many have already been allocated, early application to the Secretary of the Council is desirable.

The Gas Appliances Specification Sub-Committee, to whom was relegated the task of examining and reporting upon the master patterns and jigs, have been indefatigable in their efforts, and have devoted a considerable amount of time to this work, effecting many minor improvements which suggested themselves as the work proceeded.

### BRITISH STANDARD SPECIFICATION FOR CAST-IRON PIPES FOR GAS, WATER, AND SEWAGE.

A Committee of the Council was formed in December last for the purpose of considering the revision of the above specification; and,

on the invitation of the British Engineering Standards Association, a representative of this Committee was appointed to sit on the Association's Sub-Committee. Several meetings have been held by the Council's Committee, and a preliminary memorandum of proposed amendments has been drawn-up and submitted to the Association. These amendments relate both to the text of the specification and also to the design of pipes and special castings.

STANDARD SPECIFICATION FOR ROAD TAR.

The views of the Council with regard to the amendment of the above specification were laid before the Ministry of Transport by a deputation representing the Council, who waited upon Sir Henry Maybury. The Council were successful in obtaining most of the desired amendments; and gas undertakings using a dehydration plant ought not to have much difficulty in producing tar to the new specification.

COAL TAR FOR USE IN ROAD CONSTRUCTION.

The Council took urgent steps to counteract the progaganda of the advocates of bitumastic compounds—and in particular of the South Wales Patent Fuel Manufacturers' Association—for road dressing purposes in opposition to coal tar. Questions were asked in Parliament; and a letter embodying the views of the gas industry on the subject was inserted in a leading newspaper. The Council will not relax their efforts to convince local authorities and others concerned that coal tar can hold its own for road purposes with any bitumen compound.

DIVERSION OR STOPPING-UP OF HIGHWAYS.

In view of the prejudicial effect upon gas undertakings whose mains are left lying under the old highways which are being diverted or stopped-up, the Council, in conjunction with the British Water-Works Association, took the opinion of Counsel with regard to injury to, or diversion of, mains necessitated by road improvements. This opinion has been published in the Council's monthly reports.

MODEL BILL.

Following their practice of previous years, the Council, through their Parliamentary Agents, made representations to the Lord Chairman with regard to amendments in the Model (Gas) Bill; and some slight amendments appear in the Model Bill for the current session.

OTHER MATTERS.

*District Executive Boards and Management Committees.*—The thanks of the Council are again due to the District Executive Boards, Management Committees, and District Secretaries, for the assistance which they have never been slow to render.

*Monthly Reports.*—The monthly reports are proving an increasingly useful medium for keeping members in close touch with the activities of the Council and with the matters discussed by the Central Executive Board. Counsel's opinion on subjects of importance to the gas industry are published therein from time to time, and are much appreciated by members.

*General.*—The Council's activities have increased enormously during the past year. The attending of conferences, meetings, inquiries, &c., which deeply concern the industry, makes a big demand upon the time of the Council, quite apart from the heavy amount of correspondence which has to be dealt with.

*Income.*—The total amount received by the Council by way of joint subscriptions to the National Gas Council, the British Commercial Gas Association, and the Institution of Gas Engineers (for research work), during the period under review, amounted to £44,273, of which sum £12,660 is retainable for the purposes of the National Gas Council.

A number of the subscriptions received cover a period up to Sept. 30, 1923, and in a few cases a period up to March 31, 1924.

To the above figure of £12,660, there must be added interest—viz., £98—making a total of £12,758, of which £2041 has been carried forward (being proportion of subscriptions paid in advance) to meet the expenses which will be incurred during the financial year 1923 24. The income of the National Gas Council in respect of the year ended March 31, 1923, including the amount of £4459 brought forward from the last account, is therefore £15,176.

*Expenditure.*—The expenditure of the Council for the past year amounted to £14,153. The balance on the year's working is therefore £1023, which reduces to £1514 the accumulated deficit at the date of the last account.

*Reserve Fund.*—The sum of £1943 shown in the last account as the balance of the reserve for the purchase of suitable furniture and fittings for the Council's offices at No. 30, Grosvenor Gardens, and for the expenses in connection with the acquisition of the premises in question, is still in reserve.

*Membership.*—The total number of undertakings subscribing to the funds of the Council at March 31, 1923, was 841, representing 87 p.ct. of the total make of gas in the United Kingdom.

## THE PRESIDENT'S STATEMENT.

The PRESIDENT (Mr. D. Milne Watson), in moving that the annual report and audited statement of accounts for the twelve months ended March 31 last, as circulated, be approved and adopted, said: The year under review has been so crowded with events and happenings of importance to the industry, that I fear I cannot possibly, in the short time at my disposal, give more than a "bird's-eye view" account of the work that has been accomplished by the Council.

THE THERM.

It has undoubtedly been a notable year in the annals of the industry. The salient feature of the last twelve months has been the unprecedentedly virulent attacks upon the industry, emanating from different quarters. Unfortunately for the instigators of the main attack, they selected as their battle-ground the thermal basis of charge, in consequence of which, in November, 1922, the Government set-up a Departmental Committee "to inquire into the thermal system of charging for gas." The Council naturally played a prominent part in the ensuing inquiry, which extended over a considerable period of time. A very heavy amount of work was entailed in consequence of this inquiry; but the result fully justified the energy that was expended, inasmuch as the Committee completely vindicated the industry from the unjust and unwarranted accusations that had been levelled against it. I think there can be no doubt that the therm has come to stay. The thermal basis of charge takes the place of the rigid and uniform standard of quality hitherto imposed in individual cases, and enables the industry to utilize not only the coal resources of the country but also the plant available at the various works, to the maximum efficiency. Again, by compelling all those interested in the industry to think in terms of therms, it must ultimately, in my opinion, tend to the advancement of progressive and scientific thought in the industry as a whole. Members are, of course, familiar with all the conclusions appearing in the report of the Departmental Committee, which were framed for the purpose of ensuring that the necessary information as to the price and quality of the gas supplied should be readily available to all consumers. Difficulties have been encountered in giving effect to the procedure recommended, owing to the widely differing practice obtaining throughout the country. Provided, however, that the procedure recommended is generally adopted by the industry, I hope and believe that no further restrictive legislation in connection with this matter will be imposed upon us.

ATTACKS UPON THE INDUSTRY.

Another question which has given the Council much trouble and anxiety has been the ill-considered and thoughtless attacks upon the industry in connection with the carbon monoxide content in town gas. The wild and loose statements that have been made in connection with this matter clearly indicate a lack of perspective which is most deplorable. Statistics conclusively prove that, considering the almost universal use of gas throughout the country, the casualties incurred are almost negligible. Last year, the street fatalities in the London district alone were about eight times as many as the fatal accidents due to gas in the whole of the United Kingdom. It would almost appear, from the statements in the Press, as though the gas industry took a fiendish delight in slaying its own consumers. [Laughter.] Unnecessary though it may be to state, it should be clearly emphasized that no one regrets, or suffers more by, the death of a consumer than the gas undertaking itself. You will remember, in this connection, that some two years ago a Departmental Committee set-up by the Board of Trade under the provisions of the Gas Regulation Act distinctly laid it down that "it is not necessary or desirable to prescribe any limitations of the proportion of carbon monoxide which may be supplied in gas used for domestic purposes." The Committee also suggested that, if the freedom which they recommended was accompanied by unexpectedly unfavourable results, the attention of Parliament might, if necessary, be again directed to the matter. As far as I can see, nothing has occurred since that date which could be said justifiably to necessitate a revision of the recommendation made. Machinery has been set-up whereby the Council hope to be able to keep in closer touch both with the Press and with Parliament; and I hope that we shall not see expressed in public the same distorted views that have recently been given utterance to. Of late, advantage has been taken of the carbon monoxide "bogey" to advertise a process which it is alleged will enable gas to be sold not only cheaply, but with complete immunity to the consumer, no matter how much he abuses it and uses it in a wrong way. I regret personally that such a course as this was adopted, not only because it may be detrimental to the industry as a whole, but also because it is distinctly misleading to the public. ["Hear, hear."] I do think, however, that I am justified in saying that a much more beneficent and just attitude towards the gas industry has been shown recently; and I believe that if the public can only be kept informed of the many and great services rendered by the industry, and the care which it takes to satisfy the needs of its consumers in every way, we shall be in a much stronger position in the future to meet any campaign, whether public or personal, which may be launched against us.

INSPECTION OF PIPING AND APPLIANCES.

I cannot leave this particular subject without referring to a similar and kindred question—namely, the Board of Trade conference with regard to additional precautionary measures in the distribution of gas. Shortly after the therm inquiry was concluded, you will recollect that the Council received a letter from the Board of Trade, suggesting a conference between them and certain Government Departments and divers representative associations of local authorities—such as County Councils' and Urban District Councils' Associations, and the Association of Municipal Corporations. I have no time this afternoon to refer in detail to the different suggestions that were made; but I feel sure you all know about the whole of this subject, from the accounts that have been given in the monthly reports. The particular aspect of this subject to which I desire to draw your attention is that which deals with the necessity or desirability of a compulsory inspection and testing by gas undertakings of consumers' piping and appliances. It has always been recognized up to the present time that the liability of a gas undertaking terminates at the meter, and that beyond the meter a consumer can fix and use any appliance or apparatus he thinks fit. Furthermore, with one or two exceptions, gas undertakings have never had any control over the size and material of the piping with which the builder or landlord has carcassed the premises. Gas undertakers, like other business

men, are most anxious that they should do nothing which would incense or irritate their consumers; and consequently no attempt has hitherto been made, except in a few cases, to obtain powers authorizing them to enter any premises and condemn any particular apparatus. An Englishman's home is still—at any rate so far as the gas industry is concerned—his castle. On the other hand, it is an undoubted fact that many appliances are to-day offered for sale which cannot be termed either safe or satisfactory; and any accidents that occur in consequence of the use of such appliances or apparatus must of necessity be detrimental in the highest degree to the gas industry as a whole. If it be decided that, in the interests of public safety, additional powers on the lines which I have indicated should be conferred upon the industry, then it is clear that these powers should only be exercised with the utmost caution and tact. As I said before, the question is fraught with the utmost difficulty; but you may be assured that your representatives at the conference will, while protecting the legitimate interests of the industry, do everything in their power to allay any doubts or suspicions which unfortunately may be prevalent to-day.

### Municipalities and the Gas Regulation Act.

I should mention the fact that special meetings of the representatives of municipal gas departments have been convened by the Council to discuss their position in relation to the Gas Regulation Act and the thermal basis of charge. An interview was arranged with the Director of Gas Administration, who gave assurances which I think proved satisfactory to the deputation.

### The Standard Cooker.

You will no doubt recollect that, owing to circumstances to which I need not now refer, the Council were obliged to embark upon the work of drawing up a specification for a standard cooker, specimens of which you will see in the room. The specification—which was based upon the actual requirements of our members, as stated in reply to a questionnaire issued by the Council—has been already published and distributed; and we have here to-day the first samples of cookers constructed in accordance with this specification. Within the next few weeks, additional samples will be available for those members who have asked to be supplied with them. For the benefit of those who have been unable to obtain samples for their own use, arrangements have been made whereby a sample of each size of cooker will be exhibited at some convenient centre in each district, and will be open to the inspection of members in that district. If, as we expect, these cookers are found to meet the requirements of the industry for hiring-out purposes, there is no doubt that they will enable a considerable saving to be effected, not only in the initial outlay, but in the cost of upkeep. I refer to this matter briefly, because the ultimate decision as to the suitability of the standard cookers must rest with the great body of our members. At the same time, I feel sure you would not wish me to leave the subject without paying tribute to the indefatigable efforts of the Committee who have been considering this question. Our best thanks are due to Mr. Rogers and his colleagues for the great amount of work they have put into this matter.

### Chemical Works Regulations.

Turning to another matter which is referred to in the report, I would direct attention, specially that of the smaller gas undertakings, to the Chemical Works Regulations, 1922. These regulations—intended primarily to apply to large chemical works—would have imposed a heavy and useless burden upon the gas industry, had it not been for the representations made by the Council to the Home Office while the regulations were being framed. It has now been made clear in the regulations that gasworks as such are totally exempt, and that only that portion of a works where sulphate of ammonia is produced or tar is distilled comes within the scope of the regulations. A clause has been inserted, moreover, which enables the Chief Inspector of Factories to issue a certificate of exemption in the case of any works to which, by reason of the infrequency of the process or the small number of men engaged, it appears that these regulations should not be applied. Interviews have taken place with the Chief Inspector, as a result of which it is hoped that the industry will be fairly and sympathetically treated, and that in all cases to which the regulations could not reasonably be regarded as applicable, certificates of exemption will be issued. This, I am sure, you will be very glad to hear. The Council have already lodged applications for such certificates on behalf of a large number of undertakings; and every undertaking which feels that it should be exempt is advised to communicate forthwith with the headquarters staff.

### Workmen's Compensation Insurance.

Another question which clearly indicates the value of co-operative action is that of workmen's compensation insurance, to which I referred in my speech last year. Undertakings to the number of upwards of 200 have been enabled to reduce the aggregate amount of their premiums by no less a sum than £10,000 per annum—equivalent to about 60 p.ct. of the whole income of the Council. As and when more members avail themselves of the scheme, it is confidently expected that the rates will be further reduced. In these circumstances, it is felt that those undertakings which have not yet investigated this matter might do so with advantage to themselves.

### Tar for Roads.

You will observe from the report that the Council have been vigilant in protecting the interests of the industry as far as tar for road construction is concerned. At the beginning of the year it became known that the Ministry of Transport were proposing to revise their specification for road tar. A Special Committee was formed to obtain the views of members of the Council in connection with this important matter, and to submit them to the Ministry. I am glad to be able to report that the majority of the recommendations made by the Council were adopted, and have been embodied in the specification. I think there is no doubt that but little difficulty will be experienced by any undertaking in complying with the specification as it now stands. At the same time, I feel sure that everyone present will agree with me that it is of the utmost importance that the reputation of tar as a road-surfacing material should be maintained in all respects; and gas undertakings will doubtless make special efforts to comply with a more stringent specification, whenever such may be required. In this connection, it will not be amiss to refer to the campaign which was commenced by certain organizations which have endeavoured to influence both the Government and Highway Authorities throughout the country in the prevention of the use of tar for road purposes, on the ground that it was required for making patent fuel. Immediate steps were taken by the Council, both in Parliament and elsewhere, to protect the interests of the industry; and it is satisfactory to know that these efforts were successful in counteracting the action of these organizations, and rendering their campaign nugatory and of no avail.

### South Wales Electrical Power Distribution Company.

I do not propose to take you in detail through the many other subjects which are referred to in the report. You will see that much important work has been done, and valuable results achieved. There is, however, one matter in which we have not been successful. I refer to the South Wales Electrical Power Distribution Company's Act. You will remember that last year the Council, acting in conjunction with a number of undertakings in South Wales, opposed the Bill in the House of Lords in so far as it authorized local authorities within the limits of supply of the Power Company to invest the money of the ratepayers in the ordinary capital of the Company. During the year under review, the Council again opposed the passage of the Bill through the House of Commons; but I regret to say without much success.

### British Empire Exhibition.

This brings me to the end of my statement for the year. You will have gathered that the past year has been an eventful and busy one, in which the industry has to a large extent been compelled to stand upon the defensive; and it is in this connection that I desire to refer to a subject which does not appear in the annual report—namely, that of the British Empire Exhibition which opens in the spring of next year. This, in my opinion, will be an occasion which will enable the industry to demonstrate its true value and worth to the community as a whole. The potentialities of gas are enormous. Its business to-day is growing on all sides, and its popularity increasing day by day. The question which the industry had to decide was whether it should be represented at this exhibition, where its rivals and competitors have already determined to make a grand display. At a meeting at which all sections of the industry were represented, it was determined to exhibit at this Empire Exhibition; and personally I feel quite sure that this decision was the only one possible in the circumstances. ["Hear, hear."] I am convinced that you will all agree with me that the exhibit must be worthy of the great industry which we represent, and that we should one and all make a great effort at this exhibition to broadcast the truth—which is already so well known to all of us—that gas is indispensable to the community, and renders services to the public at least as great as, if not greater than, any other industry or trade in the country. Not only have we to face the attacks of our enemies, but we must also be prepared to meet the ignorant and futile criticism of—"The day of gas is over," "Gas is a back number," or, as I read in an electrical paper the other day, "No wonder the gas industry is gloomy." Never has the position of the gas industry been stronger—never have its prospects been brighter; but we must miss no occasion of furthering its progress and advancement. We have weathered many stormy and tempestuous seas, and are now, I am happy say, sailing into calmer waters. I need not remind you that "there is a tide in the affairs of men which, taken at the flood, leads on to fortune." So it is with industries. Our opportunities to-day are very great. Let us seize them. [Applause.]

### The Financial Aspect.

Mr. William Cash, F.C.A. (a Vice-Chairman of the Central Executive Board), in seconding, remarked that, after the admirable, masterly, and comprehensive statement which the President had submitted, it was not necessary for him to say a single word about the work of the Council during the past year. He would therefore confine himself to one or two observations with reference to the accounts, which now covered a complete period of one year up to March 31, as last year, it would be remembered, the financial date was changed. Therefore it was not possible to arrive at an exact comparison between the accounts now before them and those for the previous year; and so he had had extracted for him the accounts for the half-year, as nearly as they could be made up, to March, 1922. On this basis he proceeded to compare the

figures in the two sets of accounts. He concluded by pointing out that the balance brought into the present accounts, which was on the wrong side, had been made better by the excess of receipts over expenditure this year of £1023; so it looked as though, after another year's working, they might expect to find this adverse balance disappear altogether.

Sir William Kay (Hon. Treasurer) said the ground had been so well covered that very little was left for him to add. He would, however, like to associate himself with the statements that had been made, and to commend the resolution to the hearty support of the members.

### Co-Partnership in the Industry.

Mr. John Young, F.C.I.S. (Leatherhead Gas and Lighting Company) inquired whether it would be within the scope of the Council to put before the members a co-partnership scheme which would be of general application to the industry—not full details, but just the basis of one.

The President replied that there was already a great deal of information on the question available, as there were quite a number of co-partnership schemes in operation in the gas industry. There was also a Co-Partnership Association, who had tabulated all the schemes outside the gas industry. He himself was a great believer in co-partnership, and strongly advocated it; and if he personally could be of any service in the matter, he would be only too glad. But it would be very difficult for the industry as a whole to put forward any particular scheme. ["Hear, hear."] It would depend very much upon local circumstances. Anyone interested in the subject who applied to the Council could obtain details of schemes in operation.

The resolution was then put to the meeting, and carried unanimously.

### The President.

Alderman F. S. Phillips, J.P. (Vice-Chairman), said he esteemed it a great honour to have the opportunity of moving the re-election of Mr. Milne Watson as President of the Council. He could not conceive that anyone could have discharged the duties which Mr. Milne Watson had so well discharged in a better manner than he had done. They were very greatly indebted to him for the time he had given to the work of the Council. The report gave an indication of many of the subjects which had engaged the attention of the Council; and he need not tell them how much of the success accomplished had been due to Mr. Milne Watson's ability and personal influence. They ought to feel very grateful to him that he would again accept the position. In their relations with the Government they had been wonderfully successful; and much of this—a great deal more than it was possible to explain to them—had been due to the method, to the personality, to the unwavering devotion of the President to the interests of the Council. The Council was only a young organization; but after all it had done a very great deal in its short life, and looking back one wondered how in the world the gas industry ever managed to get along without a body which could speak for it as a whole, which could take the responsibility for it as a whole, and which could approach the Government or be approached by the Government on behalf of the gas industry. He was happy to bear testimony to the value of the President's services, and to ask them to re-elect him for another year.

Mr. J. H. Ellis (Vice-Chairman), seconding, declared that they were peculiarly fortunate in having Mr. Milne Watson as their President. He knew full well that the President would like less work. He was suffering the penalty of his own merits and his own services; but nevertheless he doubtless derived the utmost satisfaction from the fact that he was able to pull all his weight—and they knew how great that weight was—for the industry for which he had done so much in the past, and for which he would do still more in the future.

Loud applause by those present testified their hearty agreement with the proposition.

The President said he was overwhelmed by the warmth of their desire that he should remain President for another year. He had already intimated his sincere wish to be relieved of some of the work connected with the Council; but it appeared that this was not to be for the moment, and he felt that all he could do was to accede to their unanimous request. He realized that, when he had the whole of the members, the Central Executive Board, and the officers to help him in the work, they were at any rate making his task as light as possible.

### Other Officers.

Mr. Stanley H. Jones (Commercial Gas Company) next proposed the election of Mr. Alfred Morland, F.C.A., as Auditor, Alderman Sir William Kay as Hon. Treasurer, Mr. H. Wade Deacon, C.B.E., J.P., and Alderman J. H. Lloyd, J.P., as Trustees.

Bailie Stewart (Edinburgh), in seconding the motion, which was agreed to, said that while they in Scotland sometimes expressed a desire for "home rule," they recognized that it was greatly to their benefit to be connected with the Council. They appreciated highly the help the Council afforded them in dealing with many problems.

Mr. J. E. Norman (Weston-super-Mare) proposed the re-appointment of Mr. F. W. Goodenough and Mr. W. E. Price, A.M.Inst.C.E., as Hon. Secretaries. He remarked that Mr. Goodenough, as the backbone of the British Commercial Gas Association, and Mr. Price, as Hon. Secretary to the Institution of Gas Engineers, were both very well known to all of them, and they could not have men of greater experience and ability to serve them in this capacity.

Mr. A. A. Johnston (Brentford) said that, as a member of the Finance Committee, he had special opportunity of observing the work of Mr. Goodenough and Mr. Price in this connection. There was a good deal done in this way which did not appear on the surface. He seconded the motion; and it was agreed to.

### Votes of Thanks.

The President said he would like to propose a hearty vote of thanks to the Chairmen of the District Boards and the District Secretaries. This was no idle, empty resolution, for without good men to act in these capacities the work of this great organization could not be carried on. It would be quite impossible for any Central Executive Board sitting in London—however hard they might work, and however devoted they might be—to administer the affairs of the National Gas Council without the loyal assistance of the districts. He had long felt that the backbone of the Council was in the provinces, and that no amount of work in London would be able to make up for a lack of enthusiasm elsewhere. In an industry working under so many different conditions throughout the country, it was impossible that they should always take the same view; and it was greatly to the credit of the districts that, whenever a question had become a national matter, they had so loyally accepted the decisions of the industry as a whole, and had carried them out to the best of their ability in their various areas. In this way the Council were able to do the great work they were doing without friction and with conspicuous success.

The vote was cordially passed.

On the proposition of Alderman Phillips the services of the staff were similarly recognized. He said they had in Mr. Fottrell, Mr. Ogilvie, and Mr. Smith men whose hearts were in their work, who carried out their duties most efficiently, and to whom much of the success of the work accomplished was due. They were much indebted to them, and fully realized the value of the services they had rendered.

Mr. Fottrell briefly returned thanks on behalf of the staff; and this brought the meeting to a close.

## Increasing the Capacity of Horizontal Retort Benches.

How a big increase in the capacity of a battery of ten horizontal retort benches was obtained by the Russell Engineering Company, of St. Louis, without extending or re-building the retort-house—even the old pier walls, main arches, and a portion of the ironwork being retained—was related in a recent issue of the "Gas Age-Record" by Mr. Charles R. Prichard, Vice-President and General Manager of the Lowell (Mass.) Gas Light Company. The coal-gas plant of the Company, in the spring of 1921, consisted of two benches of horizontal retorts. The first consisted of ten settings, each having twelve retorts, six tiers high and two wide. The retorts were 14 ft. long by 16 in. by 26 in. section. There were eleven hollow steel buckstays on the charging side; and these also served as standpipes. Each standpipe was connected by rigid joints to six mouthpieces of one setting and to six of the adjacent setting, so that the gas from twelve retorts passed down one standpipe. The pipes at the ends of the bench, of course, only served six retorts each. There was no valve between the mouthpiece and the standpipe. The hydraulic main was in the basement. The capacity of the bench ran normally at 1½ million c.ft. per day. The bench had then been in operation about six years; and in order to put it in good condition it would have been necessary to instal new retorts, repair the producers, and erect considerable new ironwork—all at a large expense, and with no increase in capacity. It was decided therefore to rebuild the bench to ten settings of ten retorts each, 20 ft. long and 16 in. by 26 in. section; the bench to have a normal capacity of 2 million c.ft. a day. As there was ample room on the operating side of the retort-house, it was possible to extend the bench from 14 ft. to 20 ft., and at the same time to leave plenty of space for a De Brouwer charging and discharging machine. The original buckstay standpipes were retained, but were fitted with the Congdon system of cooling and scrubbing. New mouthpieces were substituted on both charging and discharging ends, because of the high expense of upkeep of the old mouthpiece lids; and valves were placed between each mouthpiece and the standpipe. The producers were rebuilt in the same location and at the same height as the original ones, but of somewhat smaller grate area. On account of the elimination of the two bottom retorts, it was possible greatly to improve the design.

**Determining the Character of Coke.**—Finding that there is considerable demand in the various industries interested for a small-scale apparatus which will determine the character of coke and bye-products to be obtained from a given coal, the United States Bureau of Mines are planning to construct a plant capable of carbonizing 100 lbs. of coal, and to calibrate it by testing several varieties of coal regarding which large-scale operating data are available. The physical properties of the coke, its combustibility, and its reactivity with carbon dioxide will be compared with the coke produced by large-scale operation; and analyses and yields of bye-products will be dealt with in a similar manner. Experiments are also under way by which the volatile matter in several varieties of metallurgical coke will be determined at temperatures up to 1700° C.

# CARBON MONOXIDE AND COMMON SENSE.

By NORTON H. HUMPHRYS.

THE leading principles which control the achievements of individuals, and by that means the collective action of companies, corporations, muncipalities, and other combinations up to nations singly or united, partake largely of the same character, under the most advanced conditions of modern civilization, as those of the lowest order of aborigines extant. Education has perhaps turned into other channels, but has not reduced, the powerful influences exercised by daring flights of imagination, or by fear of the unknown. The witch doctor or medicine man has his prot totype everywhere, and the fetish is not a speciality of the ignoran-savage. There is a preference for ready-made thinking, even in connection with the most important issues, with the result that every order of mankind has its characteristic lines of ignorance, error, and superstition.

The higher the degree of civilization, the greater the appreciation of these matters, and the better the facilities for utilizing them as a business asset. There is thus no occasion for surprise at unscrupulous endeavours to discourage the use of town gas, not by introducing a better substitute, but by creating prejudice and fear of objectionable consequences. Schemes which are not likely to be a success in fair competition are given the aid of these low-down methods; and the flourishing business does not at times disdain help in a similar direction.

The carbon monoxide bogey is a case in point. This much-maligned gas has suffered badly through both *supressio veri* and *suggestio falsi*. Expert opinion, not necessarily independent, finds favour with, and is supported by, officials who in their turn have an axe to grind; and if opinion is somewhat at variance with fact, so much the worse for the fact. The tendency is towards attaching undue importance to laboratory experiments, which are not and cannot be an accurate reproduction of ordinary working conditions. And it is time that the results of experience and common sense should also be accorded a hearing.

If this form of attack on the gas industry is attended with as much success as its opponents desire, the bottom will effectually be knocked out of any advantages conferred by the Gas Regulation Act, 1920, in the way of liberty as to the calorific value of gas supplied. Practical experience has already proved that this apparently important benefit is considerably whittled down by local conditions, and that many items other than bare economy must be taken into account. The consumers have something to say. If to these is added a scientific control under penalty clauses (for which somebody will have to pay), the resources at the disposal of gas undertakings will be restricted to special materials or processes, which must add to manufacturing costs and thus tend to injure the industry in two ways. The consumer will have to pay more, and as a consequence will use less.

No one would wish to force a cheap article on the public, at the risk of health and safety. But it is very easy for interested parties to circulate suggestions of a prejudicial character; and it is difficult to give an equally effective answer, though the material for such is obvious. The matters under examination are of sufficient importance to call for stronger evidence than an expert opinion or a laboratory experiment.

A casual perusal of the daily news-sheet might lead to the idea that the origin of carbon monoxide was coincident with the advent of the Gas Regulation Act, 1920; that under the protection of the enactment it is supplied in a form that is not detected by odour; that its poisonous character is so pronounced that even a trace finding its way into the atmosphere is injurious to health; and that such effects are cumulative. This is wandering a long way from observed fact; but as already remarked, so much the worse for the fact.

Carbon monoxide, like the poor, has always been with us. It originated with the primeval wood fire; and our ancestors who were accustomed to sit round a pile of burning logs, in an apartment provided with no other outlet for smoke than a hole in the roof, must have been remarkably immune from the effects now laid to the charge of (say) one part in a thousand. Charcoal fire baskets are, and have been, freely used. The domestic chimney may disperse, but does not prevent, the formation. Tobacco smoke has recently been shown, on sound authority, to contain as much as an average straight coal gas. A correspondent of "Chemistry and Industry" (March 16, page 275) complains that at a meeting of the London Section of the Society of Chemical Industry the room was badly ventilated, and nearly every person present added his quota of products of combustion from tobacco to the atmosphere. This reminds older readers of the weekly "harmonic meetings" which were a feature of every substantial ale-house, before the advent of the picture palace and the variety hall, to which similar stricture applied. The fogs to which closely populated districts are or have been subject, are loaded with products of incomplete combustion, which invariably include carbon monoxide; and then the natives inhale more in a week than they would be likely to get *via* town gas in the course of an ordinary lifetime. The evil-smelling products of incomplete combustion, which are familiar in the vicinity of crowded motor traffic, are not likely to be free from it. Hence the extinction of town gas would be a mere flash in the pan.

Carbon monoxide is not a novelty in connection with industrial processes. Blast-furnace and producer gases may contain as much as 30 p.ct., and the precautions for preventing escapes fall far short of those general with town gas. In the well-known Leblanc soda process one of the reactions is $Na_2SO_4 + 4C = Na_2S + 4CO$ ("Chemistry and Industry," April 20, page 384). Though about 1¼ lbs. would be produced for every lb. of $Na_2S$, all we are told is, "that it was allowed to escape." We are surrounded by possible risks and dangers, among which injury from town gas ranks high in the list of safety, and is so remote in character that it is generally ignored. Caution may be carried to a degree that makes life not worth living. All sane persons observe ordinary precautions, as prompted by experience and common sense; and hitherto these have proved quite equal to ordinary dealings with town gas. So far from such dangers being on the increase, much has been done in the way of reducing them. Immunity cannot be assured against negligence or insanity. If a leakage is allowed to continue, or a cheap type of fitting is preferred to a sound and substantial article, the blame should be placed in the right direction.

Coming to the gas industry, it is too much to expect that carbon monoxide will be absent from the retort-house, especially since the lofty central chimney stalk has given place to separate and shorter outlets from each setting; and furnaces, spent charges, &c., will add to the production. The smaller class of house, where systematic analysis of flue gases is not practicable, and the cellars, at any rate, are not well ventilated, is specially in view. Certain operations on the works—the changing of purifiers, for example—involve the escape of considerable quantities of gas; and this also applies on the district. The methods by which main and service laying were conducted up to about fifty years ago were such as to give the poisonous qualities of coal gas, when inhaled in quantity, a most searching test. But the earlier school of main and service fitters accepted slight or even severe symptoms of gassing as "all in the day's work." A common practice was a charge for connecting up a service to the main, in which one of the items was "loss of gas."

Yet the deleterious effects on the health of employees (now discovered for the first time) or need of special precautions were not recognized. That bogey of modern times, cumulative poisoning, was not known; and the main or service layer enjoyed as long a life and as hearty an old age as any other class of the community. The gentleman who recently renovated the gasfittings in the board room of the York Gas-Works, as a souvenir of having had 75 years in the service of that undertaking, probably inhaled, especially during earlier parts of his long career, a larger quantity of carbon monoxide than by any possibility could be distributed among a hundred ordinary consumers of gas. The same may be said of gas-works in the United States, even where the cupola is exclusively used to the exclusion of the retort, and where the product contains 45 p.ct. Under these conditions, large volumes of blast gases are discharged into the atmosphere at the works.

If there is the slightest foundation of truth in the suggestion that the health of gas consumers is likely to suffer through inhalation of escaping and unconsumed gas, why is it that the numerous ranks of gas-works employees do not furnish a number of physical wrecks or premature old age sufficient to attract the attention of the armies of health officers who look after the well-being of the public, and lead to enforcements of special precautions, as usual with the more dangerous industrial processes? Why is it that "cumulative poisoning" is a century or so late? Effects of this nature could have been as distinctly discerned in 1823 as in 1923.

The obvious conclusion is that the effects of diluted carbon monoxide are not the same as those produced by the pure gas. The results of inhaling, say, 5 cub.in. of pure, or 50 cub.in. of a 10 p.ct. mixture, or of taking in 1 cub.in. of the first on each of five consecutive days, as compared with 10 cub.in. of the mixture at equal periods of time, are evidently not identical. The cogency is reduced to more than a proportionate extent by dilution; and coming down to the small percentage attendant upon even an unusually large escape of gas, the consequences may be nearly negligible.

A large percentage of the comparatively few "accidents" on record shows that negligence or excessive confidence are the chief factors concerned. Ninety-nine out of every hundred users have never had personal experience of an "accident," and the consequence is that liberties are daily taken with town gas, which no one outside a lunatic asylum would apply to oil or electricity. Gasfitters of the old school may be responsible for this. They regarded escape as to some extent unavoidable; and the task of convincing them that the matchbox did not furnish a suitable test for leakage, proved long and arduous. Gas undertakings, on their part, rarely issued warning or suggested precaution.

For this reason, a return in the direction of excessive confidence, by advertising that town gas is, or can be made, "safe" and "non-poisonous," are to be depreciated equally with exaggerated statements as to dangers. Even if carbon monoxide is entirely absent, the reasonably intelligent precaution that has been established by experience is not less necessary. In one sense, the recently developed solicitude for the protection of gas users is satisfactory, as evidence of extensive use of a necessity to modern living conditions.

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The late Mr. Fletcher Herbert Stevenson, of Brooklands, Solihull, Birmingham, who died at Guildford, has left estate of the gross value of £2667, with net personalty £2540.

# BRITISH COMMERCIAL GAS ASSOCIATION.

## SOUTHERN DISTRICT CONFERENCE AT BOURNEMOUTH.

**A SUCCESSFUL series of District Conferences of the British Commercial Gas Association was brought to a close on Monday of last week, when there was a large gathering in the Town Hall, Bournemouth—under the Presidency of Mr. WILLIAM CASH, F.C.A., the Chairman of the Bournemouth Gas and Water Company. A good programme, kind hosts, and kind weather, all contributed towards making the meeting in this beautiful town a memorable one.**

As soon as those present had taken their seats for the morning session,

The PRESIDENT (Mr. William Cash) said he appreciated very highly the honour that had been done him in asking him to preside over the gathering. The Bournemouth Gas and Water Company were delighted to be able to do something to facilitate the arrangements for the conference; and on their behalf, he extended to all a very hearty welcome. The Mayor of Bournemouth had kindly consented to come and say a few words by way of opening the proceedings; but unfortunately he had been detained, and so would not be with them until later. He took this opportunity of expressing the thanks of his Company to the Corporation for granting them the use of that handsome building for the occasion. They were assembled in a town which was fortunate in the possession of most excellent administration. Between gas undertakings and local authorities it was essential that there should be mutual trust, if there was to be fair dealing, and if the concern was to be carried on in the best possible manner; and they claimed in Bournemouth that they had always had the advantage of working in harmony with the municipal authorities. At the same time, the interests of the ratepayers had been in no way neglected.

### REMARKABLE PROGRESS OF THE GAS SUPPLY OF BOURNEMOUTH.

The PRESIDENT went on to remark that he would like to take the opportunity of saying something about the Bournemouth Gas and Water Company, with which he had been associated all his business life, and which he had always regarded as his "pet baby." They were meeting in an entirely modern town, in the sense that there was no long historical record of great antiquity attached to it. The Bournemouth Improvement Commissioners were incorporated in 1856, though their area was limited to a very small portion indeed of Bournemouth as it existed to-day. In 1863 an agreement was signed between the Commissioners and certain gentlemen, including the late Mr. Edward Woods, a well-known engineer, and subsequently President of the Institution of Civil Engineers, and his (Mr. Cash's) father; and the Company were formed in 1864—the understanding being that if the Company were to undertake the supply of gas, they must also undertake the supply of water. Their first balance-sheet was issued in 1865, when they appeared to have spent on their works (both gas and water) some £14,628. The water undertaking had only been in operation for three months, so that the total receipts under that head were £137; while gas and meter rental accounted for £610. The profit for the year was £291. In the second report it was stated by the Directors with considerable satisfaction that the Company had supplied 4 million c.ft. of gas. The Board pleaded, as an excuse for the poor dividend paid (3 p.ct.), that the expenses of collection of rental and other charges were very heavy, and also that there did not seem to be any great demand for the shares of the Company—a situation which had since been very much altered. Most of the reports that followed mentioned the rapid extension of the town; and, in fact, in 1867 the sales of gas amounted to 6 million c.ft.

The original works, both gas and water, were in the Bourne Valley. In 1873, however, when the Company were incorporated by Act of Parliament, it was recited that, in consequence of the objection of the Commissioners to the manufacture and storage of gas in or near the town, the Company had incurred great expense in establishing their gas-works at a distance of about two miles from, and at an elevation of 86 ft. above, the centre of the town, and in laying down for that distance totally unproductive mains and works for distributing gas when manufactured. To those who knew Bournemouth, it would be interesting to observe how the state of affairs had altered. The gas area now extended from Hamworthy, covering the whole of Poole, Parkstone, Branksome, Bournemouth, Boscombe, Pokesdown, Southbourne, Christchurch, Highcliff to New Milton, and Milford-on-Sea—together a sea frontage of over twenty miles, with the hinterland—all the reflections of the enormous growth of the town, and the result of taking over the Poole Gas Company in 1902, and the Christchurch gas undertaking in 1914. The taking-over of the Poole Company—a policy for which their friend Col. Woodall was largely responsible—was a critical operation in the history of the Company, because it gave them facilities for water-borne coal and the opportunity of reconstructing the old Poole works on modern and up-to-date lines. As instancing the extraordinary growth of the undertaking, he quoted the following figures relating to the total quantity of gas sold:

| | Cubic Feet. |
|---|---|
| 1887 | 101,957,750 |
| 1897 | 232,862,300 |
| 1907 | 635,774,150 |
| 1917 | 1,262,040,525 |
| 1922 | 1,514,011,888 |

The total capital expenditure was £1,070,000. The turnover in 1922 was £515,000, and the profit £100,000 on gas and water taken together. As was the case with many other gas companies, their business had been largely increased by the introduction of the prepayment system; and they had now over 17,000 consumers of this class—or rather more than one-half of the total supplied. In July, 1914, the price of gas was 2s. 6d. per 1000 c.ft.; and from March 31 this year they had reduced the war prices to 8·6d. per therm, or 3s 2¾d. per 1000 c.ft. This was only 29 p.ct. increase on the pre-war charge—a figure which would bear favourable comparison with other towns.

What, asked the President, had been the main lines of policy underlying the conducting of this undertaking? First, their endeavour had been to serve the public. The Company—and the gas industry generally—were sometimes described as monopolists. This was not really true; but, in any event, they were regulated by Act and Order, and parliamentary control. They wanted to sell a good article at a cheap price with satisfaction to the consumers. To accomplish this they must have a fully qualified, efficient, and keen staff; and in Bournemouth they had been particularly fortunate in this respect. He did not want to minimize their good fortune in having a district of the character which they served; but in some respects this carried with it corresponding difficulties. So far as lighting was concerned, competition was keener than in a purely industrial area; while the rapidity of expansion had meant continual capital expenditure, which had had to be made with great care and judgment.

Alluding to the British Commercial Gas Association, the President said he was confident they were doing really valuable work. In the giving of useful hints for the training of staffs, in developing new ideas, in suggesting novel methods of advertising and salesmanship—in all these ways, the Association were doing their work well. Full knowledge of the advantages and the use of gas was not yet possessed by the public; and much could be done by way of education. In this direction, one means that might be employed was canvassing. But the canvassers must be trained and educated. They might employ advertising; but successful advertising was an art to be acquired. Showrooms might be opened; but they must be attractive, and should stock only efficient apparatus. The early days of a gas-cooker, some flat irons, and an aspidistra in a showroom window were gone; and this Association existed to show them better, and the best, ways.

### AN ACKNOWLEDGMENT.

Mr. R. W. EDWARDS (Aldershot), in proposing a hearty vote of thanks to the President for his warm welcome and for the particulars he had just given the meeting, said it had often been a matter of interest and surprise to him to notice the remarkable development of Bournemouth, and the corresponding development of the Gas and Water Company. The town possessed a most excellent supply of both gas and water; and he was sure the residents must realize this, as well as the fact that they were obtaining their gas at an extremely low price.

Alderman F. TEMPLER DEPREE (Exeter) seconded the vote, which was cordially passed.

The PRESIDENT, in acknowledgment, remarked that he did not wish to appropriate the thanks of the meeting entirely to himself. Mentioning the names of Sir Charles L. Morgan, C.B.E., M.Inst.C.E., Sir Charles J. Jessel, Bart., Mr. E. Honoratus Lloyd, K.C., and Lieut.-Col. Harold W. Woodall, C.I.E., M.Inst.C.E., all of whom are on the Board, he said he always regarded the Company as being particularly fortunate in their Directors.

### WORK AND POLICY OF THE ASSOCIATION.

Mr. F. W. GOODENOUGH (as the Executive Chairman of the "B.C.G.A.") then made a statement with regard to the work and policy of the Association. In the course of this, he pointed out that the Association had always been very warmly supported, not only in Bournemouth, but in the South of England generally. As to policy, "Concentration" was the motto of the Association at the present time. It was, for instance, felt that they could get the best results by concentrating in the matter of advertising. He made special reference to the great deal they had done in the medical and educational papers, and said he was convinced that the publication of the helpful articles for the information of teachers, and the use they knew had been made of them in instructing the next generation of gas consumers, would prove to be worth an enormous sum of money to the gas industry. If they could—as, in fact, they were doing—make information with regard to the manufacture and applications of gas part of the general knowledge afforded to the children of the country in the course of their ordinary education, they would have done much that was of value in getting business in the future. Then the competitions for children were increasing in success every

year. As to the supply of material for local publicity, there was no undertaking which availed itself more freely of the assistance of the Association, and none which did more in this direction, than Bournemouth. It was one of the most progressive gas undertakings in the country. Those of them who had had an opportunity of inspecting the showrooms in Bournemouth and Boscombe would agree that they were absolutely up-to-date. The Association claimed to be a bureau of information and advice for every undertaking; and they had very much developed the art of showroom arrangement. As the result of their negotiations with the Government, undertakings had received large sums of money towards the cost of gas installations in housing schemes, which they certainly would not have had without a very strong fight being put up. He did not think he was over-estimating in calculating that the industry had received at least half-a-million of money in this way since public housing schemes were started. Finally, there was the question of the training of assistants. He was glad to say that the salesmen's circles which the Association started in the past year had proved even more successful than had been hoped. They had in hand the preparation of a general scheme of education for the commercial side of the industry, which was very much overdue, and was by no means easy to work out in a practical form such as would meet with the approval of the Board of Education. They started upon this because they had always held that one of the most important aspects of their work was a stimulation to a higher standard of service to the community by the staffs, and even the administrations, of gas undertakings throughout the country. They felt that a policy of first-class service to the consumer was one that ought to be adopted by every undertaking. ["Hear, hear."] Until every undertaking realized that "he profits most who serves best," and until every undertaking studied the consumer first and foremost, the industry could not achieve the success which it should, and he was sure would, achieve. There was an enormous future for the gas industry; the field for its full development had hardly yet been touched. The President had given some most encouraging figures; and he believed this progress could be continued, and improved upon, by every gas undertaking throughout the country, if only they would adopt the live policy of the Bournemouth Company, based on principles which the "B.C.G.A." had always advocated.

Mr. R. W. EDWARDS said he would like to make the suggestion to the Association that it was all very well advertising, but that they should go one step farther. In the same way that a large industrial business was unable to sell its commodities unless the right representatives were put to work, the "B.C.G.A." should have a limited number of expert representatives who could be loaned to various up-to-date undertakings, not for the purpose only of teaching their staff, but of absolutely obtaining the results themselves on the ground, and so showing the staff that these results could be secured. Speaking for his own Company at Aldershot, they would be glad to pay a suitable salary to such a representative for the time it took him to achieve this work. If the Association could provide such a man at a reasonable fee, he believed other undertakings also would take advantage of the fact.

Mr. GOODENOUGH replied that this was a matter they had had under consideration. Applications had been made, and in one or two cases arrangements had actually been made. But one of the very real difficulties was to be able to ensure permanent employment to a man of the right type, who would have to give up a good job.

The PRESIDENT voiced the thanks of the meeting to Mr. Goodenough for his statement.

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A paper, accompanied by numerous illustrations and tables, was then read, on the subject of

## SALES AND SERVICE.

By PHILIP G. G. MOON, F.C.S., Engineer and General Manager of the Bournemouth Gas and Water Company.

At the present day in all efficient and well-run businesses it is a truism to say that success is founded upon the ideal of "service" taking the first and most important place in the policy of the business. The customer's needs must be the first and most important consideration; and he must get as nearly what he wants as is humanly possible, at the minimum of trouble and expense to himself. The most valuable customer—in fact, the only one who counts in the long run—is the satisfied customer. What is true of other businesses is equally, and perhaps even more, vitally true of the gas industry. Gas in the home or in the business must be a blessing, not a bother; a comfort, not a curse.

When the widespread and varied applications of gas are considered, it becomes evident how many are the directions in which gas can, in the best sense of the word, serve the community. The very wideness of the opportunity, however, brings a responsibility peculiarly its own. It is recognized by gas undertakings nowadays—and the British Commercial Gas Association have done splendid service towards securing this recognition—that it no longer suffices to manufacture gas, pass it into the mains, and leave consumers to take it or leave it, burn it or waste it in any sort of odd apparatus, just as they please, without expert guidance of any sort. The proper distribution of gas throughout the district, the careful testing of apparatus so as to secure the most efficient type for any purpose, the sale of that apparatus, the proper fixing of it, the education of the consumer in its economical use, and the efficient supervision and maintenance of the apparatus afterwards, have become the most important functions of a gas undertaking.

The growth of this appreciation of the importance of the "service" side of a gas undertaking can be gathered from the comparative record of the number of men employed on the works and district sides now and (say) over twenty years ago. In Bournemouth the figures are as follows for the years 1900 and 1922:

| — | Men employed on the Works. | Men employed on District. | Percentage District Men of Total. | Gas Made. |
|---|---|---|---|---|
| 1900 . . . | 163 | 44 | 21 | 357,000,000 |
| 1922 . . . | 458 | 444 | 49 | 1,685,000,000 |

The writer in October last, in a paper read before this Association at Bristol, gave detailed particulars of a large number of the more characteristic installations of gas apparatus which have been fitted by the Bournemouth Gas and Water Company for different purposes in their area of supply. The writer proposes in the present paper to give a few notes on "Sales Methods" and "Control of District Work," which he hopes will prove useful. It is not claimed that these are in any sense novel, or that similar or better methods are not probably in use with other gas undertakings.

### SALES METHODS.

The obvious object of any "sales effort" is to bring the advantages of any apparatus it is desired to sell before prospective customers in such a way that they can readily judge of, and be attracted by, its probable usefulness to themselves. The appeal to prospective customers can be made through various channels.

#### ADVERTISEMENTS.

*Newspapers.*—There can, one imagines, be little question at the present day as to the value of newspaper advertisements, always provided, of course, that the "matter" is right and the display as it should be. Without these qualifying considerations, the advertisement can be almost useless—in fact, sometimes positively harmful. Generally speaking, the gas advertisement should advertise a "policy" rather than a "price-list"—should preach a gospel rather than waste its effectiveness on the price of mantles or accessories. There is, moreover, no excuse for any gas undertaking which uses poor or ineffective advertisement nowadays.

The very excellent publications of the British Commercial Gas Association dealing with advertisement suggestions cover a very wide range of special subjects, and offer a splendid selection of display matter and blocks for illustration. They represent the best type of advertisement practice, and can be used with great advantage by every undertaking.

The British Commercial Gas Association look after the national advertising, and very excellently they do it; but it is emphatically the duty of individual undertakings to drive home in their own area the gospel of "Gas Service" by consistent and arresting local advertising.

Incidentally, in referring to the question of national advertising and the good work done by the British Commercial Gas Association, it is necessary to point out that all undertakings profit by it, though all undertakings do not subscribe towards it. It is probable that gas undertakings which do not subscribe—and there are still unfortunately quite a number—have not realized how much is being done by the Association and the extent to which they are profiting by national work towards the cost of which they are not paying their share. A proper realization of the position, one ventures to hope, will lead to a fuller financial co-operation.

All the local newspapers published in the supply area of a gas undertaking should have their adequate share of advertisements; and, further, all the editors of them should be kept well informed on all general questions of gas policy and development. Most, though not all, of the unfair criticism which arose over the therm agitation were really the result of lack of knowledge more than anything else. Those undertakings, at any rate in the provinces, that took the trouble to keep their local editors, and incidentally their local authorities, properly advised, had very little trouble in this direction. Editors are very human, and, generally speaking, are anxious to put true facts before their readers. It is up to the gas undertaking to see that they are kept well informed.

*House-Agents' Pamphlets.*—In most towns, but especially in a town like Bournemouth, there is a large number of house and estate agents with important business connections, who publish regularly their own guide or booklet. As the latter are specially printed with the object of sending them to prospective new residents, an advertisement in them reaches just the people to whom the gas undertaking wishes to appeal. In addition to the advertising value of these publications, much useful information as to the names and addresses of prospective new residents is obtained from these agents.

*Posters and Programmes.*—Posters and programmes come into rather a different category from the previous methods of advertisement; and their value is, in the writer's opinion, much more debatable. Posters for a special campaign can serve a most useful purpose; but except for such a purpose, it is doubtful whether the expense involved brings any really adequate return. And in the same way, it is very doubtful whether programme

advertisements ever secure the attention from the programme purchasers that is claimed for them.

### Distributed Literature.

A very useful, and often neglected, advertising medium is the "Demand Note." It reaches every consumer, nearly every one of whom could profitably find some additional employment for gas, if only the right "thought wave" could be started in his brain. It is worth giving this a little more consideration than is often done, always remembering, however, that though "price" counts, and counts largely, it is "policy" rather than price that starts the thought wave. It is the mental picture of the comfort and convenience resulting from a gas-fire in a certain room that appeals first of all—the price to be paid for it only arises if the picture appeals.

### Special Literature.

It is the literature specially written to appeal to doctors, architects, and schoolmasters that probably does most effective work in advancing the popularity of gas. These gentlemen represent the professions that influence public opinion on matters of health, household efficiency, and general education; and any pronouncement made by them bears the stamp of authority, and rightly carries great weight with the community generally. It is therefore of the first importance that those who inform the public shall themselves be properly informed; and it is up to the individual undertaking to see that specially prepared information is put at their disposal. Fortunately the British Commercial Gas Association, by their various excellent special publications, have made this particularly easy.

The Bournemouth Gas and Water Company forward copies of these publications to the doctors, architects, and schoolmasters in their area of supply, and follow them up by the visit of a specially trained representative. These special canvasses are always tabulated; and the result of a recent one may well be quoted here. A letter was sent to the whole of the doctors in Bournemouth, Poole, Christchurch, and that part of the surrounding country which is served by the Company, drawing attention to the high hygienic and labour-saving properties of a properly-fitted gas-fire, and offering to fix, without charge, a gas-fire in any room for a three months' trial. At the end of the period, the fire could be returned, if so desired, or could be retained by paying the cost price of the fire without any charge for fixing. It is of interest to note that not one doctor took advantage of this offer. At first glance, this appears to be a sorry result; but when the reason for it is given, it will be obvious that it is really a splendid testimonial to the effectiveness of the policy that has been consistently followed in Bournemouth for so many years. The preaching was to the converted! There are 142 doctors in the Bournemouth Company's area, and of these 134 use gas for heating, two use electricity, and six use anthracite or ordinary coal only. The gas apparatus in use by the 134 doctors comprised 113 cookers, 415 fires, and 56 water-heaters. In addition, orders were received (without taking advantage of the "approval clause") for a further 4 cookers, 23 fires, and 4 water-heaters. Practically all the doctors using gas were free from any prejudiced views regarding its use, and in fact, in most cases, spoke highly of it from both the hygienic and the labour-saving points of view. Probably no better illustration than the result this canvass could be given to emphasize the advantages to be gained from the consistent use of special literature and good canvassing.

### Special Trade Literature.

There is another form of literature that could be used with advantage much more than it is. I refer to the "Thousand-and-One Uses for Gas." Practically every known application of gas is embraced by this excellent series, and the detailed information given, usually with costs and examples, is of inestimable value to the really alert gas undertaking.

### New Residents.

As a result of the information gained from the house agents, the names and addresses of new residents are usually available before they actually come into the district; and it is the practice to send the Company's application forms to them, together with a well-chosen selection of literature and a list of apparatus and prices. This is accompanied by a carefully drafted standard letter emphasizing the advantages of gas, and offering to send the Company's representative to meet them at their new residence at any time suitable to them. So successful has this been that very often the whole of the arrangements are fixed-up by correspondence, and on some occasions the gas apparatus is installed before the consumer is even seen.

### Canvassing.

Advertising of every kind, special literature, correspondence generally, all serve to bring the undertaking into some sort of touch with prospective customers; but up to this point the important personal element is absent. That is where the canvasser or special representative comes in; and it is usually as a result of his efforts that the reward of the advertising is reaped in the shape of orders.

It is impossible to lay too much stress upon the careful choosing and training of these representatives. They must be properly informed upon all questions of comparative costs and on the suitability of suggested positions for any given apparatus, must be prepared to meet prejudicial views with patient and tactful arguments, must be careful to claim for gas only as much as can be safely fulfilled, and, above all, must be prepared to measure up and price out any ordinary job and give a quotation for it on the spot. This combination of good training, tactful address, and practical experience is a difficult one to obtain; but it is vitally necessary and all important. Courteous replies, reliable information, convincing arguments, all are to the consumer his first introduction to the gas undertaking; and by the representative he judges the undertaking.

In Bournemouth practically all representatives are trained gasfitters who have had the craftsman's experience of fixing and maintaining every class of apparatus the Company supply. They have been chosen because of their good address and general education, and have been specially trained to deal with consumers on tactful and efficient lines. It is quite true that in Bournemouth is found a class of consumer on the average somewhat better off financially than in some towns; and this accounts to some extent for the large and well-maintained sale of gas apparatus. But it is probably safe to say that an even greater reason for it is to be found in the keenness and efficiency of the canvassing representatives of the Company.

The payment of commission on fresh business is a policy of which all undertakings do not approve; but it is one that undoubtedly works well in Bournemouth. However keen a man may be, it is only human to expect that his keenness is likely to be better maintained if there is something tangible coming to him as a reward for successful business-getting. In this connection, too, it is well at this point to say that a trading account or commission is given to all builders, ironmongers, and gasfitters who effect sales of gas apparatus; and commission is also paid to all employees of the Company for sales effected by them. The rates of commission are as follows:

*Inspectors and other Employees:* 2s. 6d. for each order for a new gas service obtained. 2s. 6d. for each order for a new cooker, fire, or water-heater.

*Showroom Managers and Canvassers:* 8d. for each order for a new gas service obtained. 2½ p.ct. on the value of all cookers, fires, water-heaters, and lighting fittings sold.

*Builders, Ironmongers, and Gasfitters:* 15 p.ct. commission on all apparatus recommended by them and sold by the Company to their customers; 15 p.ot. on all apparatus purchased from the Company and sold direct to their own customers.

The commission paid by the Company for the year 1922 was as follows:

| | |
|---|---|
| Company's employees . . . . . | £995 |
| Outside agents . . . . . | 1394 |
| | £2389 |

While dealing with this question of canvassing and commission, it is perhaps useful to show how it inspires everyone to definite effort, once a line of action is pointed out. A few years ago the hotel bedroom gas-fire propaganda was started; and it was soon fairly obvious to all the Company's representatives that it offered a very fruitful field of labour. They were all quickly at work, full of enthusiasm, in their own definite areas, and very anxious to beat their fellow workers' records. As a result of their labours there are now some 2600 gas-fires in the hotels and boarding-houses of Bournemouth, and, more interesting still, an examination of the last issue of the "Official Bournemouth Guide" revealed the fact that 41 of the advertisers therein thought it of sufficient importance to claim as one of the advantages of their hotels or boarding-houses that there were gas-fires in the bedrooms. In the same Guide there are 65 other establishments which have gas-fires installed, though they do not advertise the fact. There are 145 advertisers in the Guide; and of these at least 106 have gas-fires in their bedrooms.

### Showrooms.

A very important part of the publicity side of an undertaking is its showrooms. Having regard to the opportunities offered for special display, it is surprising how content some gas undertakings are to allow their valuable showroom windows to be used for an uninteresting collection of glassware, mantles, and ugly castings which are very seldom changed. The showroom windows should always strike some arresting note that will cause the public to stop and look, instead of passing by with the subconscious thought of "Oh, it's only the gas showrooms."

A good rule is to insist on a complete change every fortnight at least, and to put it up to the particular showroom manager to bring forward suggestions with plans and explanations for the next display. Very useful and attractive suggestions have resulted at Bournemouth; and in some cases the crowds have been such that the services of a policeman have had to be requisitioned to keep people moving on.

An interesting result of the window display showing the resistance of silica globes to heat and water can be usefully quoted. A record was kept of the comparative quantities of glassware and silica ware sold. The proportion of silica ware mounted very rapidly until it reached 75 p.ct. of the total sold. At this point it was felt that the consumers had given a clear indication of the relative advantages of the two materials; and it was decided to discontinue the sale of glass altogether. The sales of silica globes and shades have now reached the old combined figure, and amount to over 10,000 pieces a year. When one visualizes the many annoyances caused by the breaking of glass as a result of a broken mantle and consequent flame impingement on the shade, it is easy to realize what an important step the substitution of silica for glass must mean in the popularizing of gas for lighting.

The interior of the showroom has opportunities for sales developments that are only limited by the size of the showroom and the ingenuity and sound business sense of those in charge of it. The showroom should not be regarded as a store, except for maintenance items—such as mantles, shades, flexible tubing, &c. It should contain rather a careful and pleasingly arranged selection of all the varied types of apparatus which careful tests have proved to be the best of their kind from both an efficiency and artistic standard. The showrooms should not stock or sell apparatus that is not efficient or good just because some specious advertisement by the makers in the Public Press leads to its demand. The showroom management, by virtue of its superior technical knowledge, should guide the public in its choice, even at the risk of losing an immediate sale. If the showrooms are sufficiently large, a series of well-arranged typical gas installations in their proper domestic surroundings is a great attraction.

### Exhibitions.

Another useful means of popularizing gas is to be found in local trade exhibitions, where the gas stand can usually be made an interesting centre of attraction. Such exhibits should, however, be of the highest standard and very thoroughly carried out, or they are better left alone. An exhibit that takes the form of a showroom counter, with an odd collection of ironmongery as its chief attraction, excites little interest, and is likely to do little real good.

Cookery exhibitions, usually arranged entirely by the local gas undertaking, do a certain amount of good, but probably more by the publicity that is secured for them than by the actual attendance of the consumers. Those who do attend are usually already good consumers who are looking for new recipes and cooking tips, rather than seeking for conversion to the use of gas for cooking. At the same time, a reasonable number of cooking lectures is always desirable, especially having regard to the many people who even now use the hotplate so much more than the oven of their gas-cooker. The best method of dealing with this aspect of gas cooking is, however, undoubtedly to be found in the employment of cooking demonstrators who can attend at the consumer's house and explain any difficulties on the spot.

### Maintenance of Apparatus.

A most important part of any modern distribution organization is the maintenance department. The aim of the maintenance system should not be so much the making of a profit as the endeavour to ensure that, as far as possible, every piece of gas apparatus on the district shall be clean, properly regulated, and working with its maximum efficiency, and that the consumer, who is in most cases quite untechnical, is relieved of the trouble of making the necessary adjustments to his apparatus.

The charges should be kept low, so as to appeal to the consumer; and in Bournemouth they are: 2d. for each lighting burner cleaned and adjusted; 6d. for each fire cleaned and adjusted; 1s. for each cooker adjusted. These charges are for labour only; but it is found that the actual cost of the work is considerably more than is represented by the above scale. Any materials which may be required are supplied at ordinary list prices, on which there is, of course, the usual trading profit. This profit, taken on the average of the burners dealt with, practically makes-up for the loss on the labour costs; so that it can be said that the maintenance scheme in Bournemouth just pays for itself, and is carried out without profit or loss.

## CONTROL OF DISTRICT WORKS.

So far this paper has dealt with a few notes on some of the methods employed to popularize gas and secure the sale of apparatus. The orders, having been secured, must be executed with the minimum of delay and the maximum of efficiency; and in most undertakings an elaborate and efficient organization is now in use for the purpose of following the subsequent operations through every stage until the various jobs are completed. Some form of card system is usually employed; and this, while excellent in its way as far as the individual job is concerned, does not, without some special provision, allow the official responsible for the district work to judge accurately the position of the work as a whole from week to week.

### Progress-of-Work Record.

The special provision at Bournemouth takes the form of a weekly summary of the more important classes of work in the six districts into which the Company's area is divided, so arranged that the position of the work in each district can be seen at a glance. The six summaries are in turn combined to form one summary for the week of the work in the whole of the Company's area of supply. With such a summary before one, it is easy to see whether the work is being dealt with sufficiently expeditiously; and a study of the separate district summaries enables the District Superintendent to vary the number of men in the different districts, as may be shown to be necessary by the varying records of progress.

### Sale of Apparatus Return.

Another useful weekly return that enables the work of the showrooms and canvassing staff to be judged, as well as the general volume of the new work obtained by the undertaking, is the "Sale and Hire of Apparatus Return." The bulk of the business done by the Bournemouth Gas and Water Company is on the sales sides, a large proportion of the sales being made on the hire-purchase system. The sale rather than the simple hire of apparatus is the result of a definite policy; and though it is probable that all undertakings would not be able to place a sufficiently large amount of apparatus by such a policy, it is suggested that it is one which should be followed as much as possible. Such a policy, however, demands that the apparatus sold shall be of high efficiency, and calculated to last a large number of years.

### New Houses Return.

A most important part of the work of the distribution department is to keep a careful record of every house started in the area of supply and to take every possible step to secure provision for the fullest use of gas throughout. Early application and a carcassing policy based on a low price per point usually succeeds in securing a very satisfactory number of points while the actual building is in progress. Each of the six District Inspectors is responsible for keeping the building record in his particular district; and his record is tested from time to time by a tour of his district by the District Superintendent. The records of all districts are summarized each quarter, and the results incorporated in a "New Housing Piping Summary."

### Record of Complaints.

An impression obtains with some undertakings that a very limited "Complaint List" is necessarily a sign of satisfactory district conditions. While obviously it is not only desirable, but a primary duty, to keep complaints down to the very lowest limit, it must be observed that a low complaint list is only satisfactory if it really does represent the whole of the causes for complaint in the district. It is to be doubted if any complaint list really represents this; and it should be the duty of every undertaking which really wishes to live-up to the "satisfactory service" ideal, to encourage and seek out causes for complaint as much as possible. When one considers that in the Bournemouth Company's area, for example, there are probably over 100,000 pieces of cooking and heating apparatus, 30,000 meters and services, 200 to 300 miles of gas-main, besides a very large number of gas lighting burners, and when, further, one remembers the sensitive character of many of the adjustments and the fairly continuous use that most of the apparatus gets, it is obvious there must always be a proportion of these different things needing expert adjustment, repair, or cleaning. It is in the gas undertaking's own interests that any troubles should be known and put right without delay; and a complaint list that is too low should, therefore, always be viewed with suspicion. In Bournemouth, a weekly summary of all complaints is prepared.

To encourage the reporting of all matters connected with the Company's supply that need attention, a series of prizes is offered each quarter to those members of the Company's staff (office, works, or district) who bring in the largest number of *bona fide* complaints. This has proved a very useful innovation, and has resulted in every man who works for the Company developing the "observant eye" for any matter, however small, which detracts in any way from the perfect service which it is the Company's desire to give their consumers. The amount distributed in prizes for twelve months was £19 17s. 6d.

Complaints should be dealt with promptly, and, if possible, upon the same day that they are received. Any complaint, the card for which has not been returned as completed within three days, is made the subject of a special inquiry by the Complaints Inspector. For the purpose of keeping control over the handling of complaints, the Company use a loose-leaf book, in which all these are entered as received. From this book the complaints fitters' cards are made out; and on the return of the card, when the complaint has been dealt with, a corresponding entry is made in the book. When all the complaints upon one sheet of this book have been attended to, it is transferred to a record file, so that the current book contains only such complaints as have not been finally dealt with. It is therefore easy for the management to ascertain by a simple inspection of the book that no complaint has escaped attention. The cards as completed are filed away in a street index cabinet, so that a too frequent repetition of the same complaint from one house can be investigated.

### Mainlaying Record.

There is a great deal of activity in estate development and the building industry in Bournemouth at the present time. This naturally leads to a large number of applications for mains, the extent of which can be judged from the fact that for the year ended March 31, 1923, 41,000 yards of main (gas and water) were applied for. Of this, 20,000 yards have been sanctioned, on suitable terms. In addition to this, 8500 yards of trunk main for water and gas, varying in diameter from 8 in. to 20 in., have been laid. It is important to watch carefully the progress and cost of this work; and a weekly summary giving the data is therefore prepared.

### Weekly Summary Records.

There are many activities in connection with the distribution side of any reasonably large gas undertaking with which it is desirable that the management should keep closely in touch. At the same time, there is very little opportunity of going too closely into details; and so a number of weekly summary records similar in purpose to those already referred to are prepared for the guidance of the management, dealing with every phase of the district work. They are brought up on different specified days, so that the records to be examined on any one day never exceed a reasonable number. This takes a very short time each day; yet by the end of each week a clear idea is obtained of all that is

going on, at any rate as far as the more important routine work is concerned.

It is hoped enough has been said to show that there is a great and ever-growing field for gas; and the last note of this paper must be the same as the first note—that the only way to secure the full fruits of this wide opportunity lies in the words "Good Service."

### Discussion.

Mr. W. J. SANDEMAN (Croydon) remarked that they had had an excellent paper. The practice at Bournemouth was almost identical with that at Croydon; but, at the same time, he must say that the practice they had adopted at Croydon had been largely copied from Bournemouth. A good many years ago he got from Col. Woodall particulars of the excellent card system he had in use at Bournemouth. One thing in Mr. Moon's paper he was very glad to see emphasized—namely, the steps he took to get into touch with people before they moved into houses. This was a very important matter, to which he would urge all undertakings who had not already done so to give attention. In Croydon they secured an enormous amount of business in this way. It was an entirely different proposition dealing with people when they were in their houses and the carpets were laid, &c. He noticed that they charged 2d. in Bournemouth for each lighting burner cleaned and adjusted. What was the actual cost to the Company of burner maintenance? There was also 6d. for each fire cleaned and adjusted. Were all the fires sold?

Mr. MOON: All sold to consumers; no simple hire.

Mr. H. C. SMITH (Tottenham), referring to the fact that Mr. Moon had read a paper at the conference last October of the "B.C.G.A.," remarked that it said a lot for the distribution system at Bournemouth that he should have been able to prepare two so widely different papers on the subject within such a short period. He could not help envying the Bournemouth Company their district, with so many big hotels fitted with a large number of gas-fires. The Company's showrooms were filled with first-class things which it was a pleasure to see. He agreed that the most valuable consumer was the satisfied consumer, and that it was their duty to keep complaints down to the very lowest limit. A satisfied consumer was the best advertisement they could have; and a dissatisfied consumer was the worst. In order to find out at Tottenham whether their consumers were satisfied, they instituted a scheme of writing and asking them. A fortnight after any new piece of apparatus had been installed, or any job done, they sent the consumer a circular-letter referring to the work recently carried out, telling him the Company were anxious for him to be thoroughly satisfied, and asking whether this was the case. A stamped post-card was enclosed, printed so that all the consumer had to do was to strike out a "NOT" or leave it in, as he desired. They sent out about 350 of these letters weekly, and had altogether posted several thousands. About 90 p.ct. came back from consumers saying they were satisfied; and about 5 p.ct. sent a letter as well, stating that they were very pleased. It had been gratifying to find the consumers so satisfied. If a consumer did not return his post-card within a certain time, he was written to again; and if there was still no reply, an inspector called upon him. They thought the scheme was well worth, as an advertisement, the £200 or so yearly which it cost them.

Mr. J. W. M'LUSKY (Glasgow) said they always expected something good from Bournemouth—and got it. That their ideas were copied with success in other places, was sufficient proof of the efficiency at Bournemouth. With regard to the commission paid to employees for new business, they had never found this necessary in Glasgow. On the contrary, the new business was coming along more quickly than they could cope with it. How did Mr. Moon deal with the difficulty of the different opportunities of the men in meeting the public? It was difficult to compare the maintenance costs given with Glasgow, because they were differently set out. In the Glasgow scheme which was being tried for the maintenance of lighting burners and cooking and heating appliances, the labour was free, and all material used was charged for. It was anticipated that this scheme, by reducing the complaints, would ultimately pay for itself; and in the meantime it would cost from 1d. to 1½d. per 1000 c.ft. of gas sold. In other words, it meant that a consumer using 30,000 c.ft. of gas per annum would be paying in his account 3s. 9d. for so-called free maintenance. A report prepared for submission to the Corporation showed an enormous reduction in complaints and a great increase in satisfactory supplies. The portion of the community in which the experiment was being carried out was never before so well supplied; and he felt sure they would get the Corporation to adopt the system throughout the whole city. Maintenance was more important than new business. He was glad to hear the importance of good showroom displays emphasized. Mr. Moon was well maintaining the good traditions of Bournemouth.

Mr. W. L. WESTBROOK (North Middlesex Gas Company) pointed out the necessity of getting control of carcassing work. This matter was of vital importance to a gas undertaking, and could not safely be left to the outside plumber, because he had to cut his price in competition with other men, and so did not put in what was adequate. His (the speaker's) Company were getting hold of the builders fairly well, and securing carcassing work by doing it at cost price. He knew that in some parts the outside plumber had to be looked after; but they must either subsidize him or do the work themselves. It did not do to leave the size of pipes to be determined by competition. In the matter of hot-water systems, it would do a lot of good to give lectures by experts to builders and plumbers. Money would be well spent on instructing them in the latest methods of hot-water fitting, thermostat adjustment, &c. He thought gas companies were now keenly alive to the importance of cutting out all unnecessary labour, and expediting work in every way. Did they give their estimates on the spot at Bournemouth, because the consumer was apt to date the placing of an order from the first time he came in contact with the gas company? As to the system of recording complaints, it struck him that at Bournemouth there was a little duplication of work. Did they use the same complaint card for a second and subsequent complaints?

Mr. MOON: We make out a separate card for a second complaint.

Mr. WESTBROOK: We use the same card for perhaps eight or ten complaints from the same house; and it may cover several years.

Alderman F. TEMPLER DEPREE (Exeter) said that they had had a good deal of difficulty where he came from, because in new workmen's houses arrangements had been made for putting in gas for lighting. The gas was supplied by a company, and electricity by the local authority, who wanted to know why electric light could not be used. This led to much discussion. Had the author experienced the same difficulty? Eventually it was found that these houses could only get a grant from the Government either for gas or electricity; and it was wisely decided that they should be gas lighted.

Mr. R. W. EDWARDS (Aldershot) inquired what the author's experience had been with spun pipe. Was he quite satisfied with it? They had developed gas extensively in Bournemouth for all sorts of purposes; and he took it Mr. Moon had some figures as to the consumption per head. He quite agreed with him on the question of commission. In his own case, the six or seven district inspectors were subjected to an annual review of their work. This work was equated to a common factor; and prizes were given for the best results. The plan had proved very beneficial. As to publicity, it had been rightly stated that much depended upon the goodwill of the newspapers. So far as his own Company were concerned, the local Press were of the utmost value and assistance. In whatever they might do to devise new methods of advertising, they found they were greatly helped by the papers.

Mr. MOON, in reply, said he very much appreciated the many kind expressions that had fallen from the various speakers. He regarded himself simply as one of a team, and so did not take the compliments as intended for himself personally. He had only been telling them what the Bournemouth district staff had done. They worked together in an excellent team spirit, each one pulling for the good of the concern; and he was always gratified to find how proud the staff were of the Company for which they worked. Speaking of the team spirit, he must pay tribute to Mr. Keen, their District Superintendent, who was full of enthusiasm and good work for the improvement of gas service. Having said this, he wished to add that, while one could admire the full-grown oak, and say what a fine tree it was, credit must be given to the acorn from which it sprang. Thus, whatever the members might think of the "tree" which the Bournemouth district organization represented now, it should remember that the "acorn" from which that organization sprang was the inspiration of his late Chief and present Director, Col. Woodall. The actual cost of labour for each lighting burner cleaned and adjusted was about 3·6d., as against the 2d. which the Company charged. The scheme explained by Mr. Smith for finding out whether consumers were satisfied with work when it had been done, was very interesting, and should be useful. In Glasgow, Mr. M'Lusky said, the difficulty was to keep pace with new business. This ought to be the case with every undertaking in the country, because gas was right on the upward curve at the present time. It adapted itself in a most extraordinary way to every phase of commercial life. Mr. Westbrook's remarks with regard to carcassing were quite correct. One could not appreciate too highly the opportunity that a good carcassing policy gave to a gas undertaking. The Company endeavoured as far as possible to give estimates for work on the spot, though this could not always be done. An approximate estimate was, however, invariably given on the spot, which enabled the consumer to some extent to know the outlay he was about to incur. These approximate estimates were subject to confirmation, in the case of larger orders, from the office, which confirmation was sent on the same day. The houses to which he referred in his paper as being built in the town were not part of any housing scheme. With regard to spun pipes, this was a new process; and in order to say anything definite, one must have had years of experience with them. At the same time, some idea must have been formed of their probable life before there was justification in ordering them. They had tried certain experiments with regard to tapping. Though there was a smaller thickness of pipe to tap into, the quality of the pipe, the fineness of the metal, and the character of the thread one could make with it, resulted in an equally strong job as with the ordinary somewhat thicker sand-cast pipe. He hoped they would last as long as, or even longer than, the sand-cast pipes. He had been asked as to the gas sold per consumer. The latest figures he had by him were for 1921, when the average consumption per slot-meter user was over 26,000 c.ft. per annum; and the average per ordinary consumer was just over 47,000 c.ft., for the whole of the Company's business. The annual review of work done to which Mr. Edwards had referred was very interesting; and it would be nice to have further details. It was easy to say that everything was equated to some common factor; but the real difficulty must be to equate it in any satisfactory way. In Bournemouth they owed a good deal to their local Press, who used the information given them with discretion, fairness, and a desire to give to their readers a correct representation of the facts.

Mr. F. W. GOODENOUGH, in proposing a hearty vote of thanks to Mr. Moon for his paper, said the "B.C.G.A." felt they had done another good service to the industry in getting him to prepare it. He would like to emphasize the author's points that representatives must be careful to claim for gas only as much as could safely be fulfilled, and that the consumer judged an undertaking by its representatives. In this connection, courteous, sympathetic, and tactful telephone operators and counter clerks were a real asset to an undertaking. He did not agree with the author's view as to the doubtful value of programme advertising. Judiciously embarked upon, this form of advertising should prove profitable.

Mr. W. M. MASON, who seconded, said their thanks were certainly due to Mr. Moon and his staff, not only for the work put into the paper, but for all that had been done in connection with the conference.

The PRESIDENT (Mr. William Cash) congratulated Mr. Moon upon his paper, and associated the Directors of the Company with the thanks accorded him.

### LUNCHEON.

The conference then adjourned for luncheon in the Town Hall, on the invitation of the Bournemouth Gas and Water Company. Mr. Cash occupied the chair, and was supported by the whole of the members of the Board. Those present also included

the Mayor (Alderman C. H. Cartwright) and the Town Clerk. Mr. Cash submitted the Loyal Toast, and subsequently "The British Commercial Gas Association," whose help to the industry he cordially acknowledged. He went on to point out that nowadays a gas company, to be efficient, must do a good deal more than was the case in times gone by. With all the assistance the Association could give, they were dependent upon the staff and administration to make an undertaking the success which it ought to be. He learned that about 85 p.ct. of the output of gas in the United Kingdom was now affiliated with the Association; but there were still undertakings which should join up. Mr. F. W. Goodenough, in response, thanked the Chairman and Directors for their hospitality, and congratulated the Company upon the policy pursued in the administration of their affairs—a policy founded on sound principles, which had led the undertaking to the wonderful position it occupied to-day, and would lead it to a position of still greater prosperity in the future. Mr. J. H. Ellis (the Chairman of the Plymouth and Stonehouse Gas Company) proposed "Prosperity to Bournemouth," which he added was assured—due, no doubt, in part to its extreme beauty, its great salubrity, and its excellent railway facilities. But all these things would count for nothing unless a town was well ordered and well administered, which was certainly the case in Bournemouth. The Mayor, replying, paid a tribute to "the excellent Company who served them with gas and water." He said the very best relations had always existed between the Corporation and the Directors, who loved the town and were therefore anxious to advance its interests. The toast of "The Visitors" was submitted by Mr. E. Honoratus Lloyd, K.C. (a Director of the Company), and responded to by Dr. H. W. Russell Bencraft (Southampton), Mr. F. J. Baker (President of the Bournemouth Chamber of Trade), and Mr. C. J. Whitting (President of the Bournemouth Rotary Club).

During luncheon, the band of the Bournemouth Gas and Water Company (Bandmaster, Mr. W. Ambrose) played in the grounds of the Town Hall.

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In the afternoon there was a well-attended public meeting, at which Dr. C. W. Saleeby, F.R.S.E. (Edin.), lectured on "Light and Life."

A feature of the conference was an excellent sales exhibit by the "B.C.G.A."

# THE INSTITUTION OF CHEMICAL ENGINEERS.

**The First Annual Corporate Meeting of the Institution of Chemical Engineers was held at the Engineers' Club, Coventry Street, Piccadilly, on Friday, June 8—the President (Sir Arthur Duckham, K.C.B.), in the chair.**

The Report of the Provincial Council of the Institution stated that the Nomination Committee had considered 205 applications for membership, and 114 had been accepted by the Council, consisting of 79 members, 34 associate members, and 1 graduate. Joint office accommodation has been secured with the Chemical Engineering Group of the Society of Chemical Industry, at No. 307, Abbey House, Victoria Street, Westminster. The Council have agreed that the Institution shall take part in the British Empire Exhibition, to be held in 1924, and that the sum of £25 be allocated as a donation towards the Chemical Section of this Exhibition.

The accounts of the Institution, which were presented, showed that the financial position was good.

The result of the ballot for Members of the Council was as follows: Messrs. H. Talbot, J. Arthur Reavell, C. S. Garland, W. B. Davidson, Sir Alex. Gibb, W. Macnab, Col. Sir F. L. Nathan, Jas. MacGregor, and W. Newton-Drew. The Associate Members on the Council are: Messrs. R. C. Browning, A. L. Booth, and E. C. Randall.

The following Honorary Officers were re-elected unanimously:

*President.*—Sir Arthur Duckham, K.C.B.
*Vice-Presidents.*—Dr. Charles Carpenter and Mr. K. B. Quinan.
*Hon. Treasurer.*—Mr. F. H. Rogers.
*Hon. Secretary.*—Professor J. W. Hinchley.

A permanent Registrar has not yet been appointed; and meanwhile, Mr. C. S. Garland has offered to assist the Institution in this capacity.

The PRESIDENT, speaking on the question of the education of the chemical engineer, related some of his recent experiences in America. It might interest the members, he said, to know the kind of work which was being done there. He had visited the Koppers Company and the Massachusetts Institute of Technology. Throughout his tour in America he had had in his mind the question of the training of the chemical engineer. America was the only country in the world that had endeavoured to train, or to give a real curriculum for, the chemical engineer. Before he went to Boston, he had visited the Mellon Institute in Pittsburg, part of which was doing the sole work of the Koppers Company. The other part was open for ordinary general industrial work, and in that Institute there was undoubtedly a fine training ground for chemical engineers. Some of the experimental work varied from the testing of cardboard boxes for carrying butter and other substances, and the feeding of white mice and rats on different foods containing vitamines, to ceramic work, firebrick work, &c. He had been intensely interested in that a firm, or a group of firms, should institute a fellowship, as it were, at this establishment. Here there was the closest touch between research and industrial work. When he had visited Boston he was oppressed by the laboratories, by the apparatus, and by the arrangements made for the education of the young man, as well as by the remarkable arrangements for giving reports of scientific work to industrial people. Really, while he was at Boston, he did not see how England could possibly hope to compete with the Americans on industrial development on the chemical engineering side. At first it seemed to him that the arrangements in this country were so insignificant, as compared with the development in America, that there was but little chance in the future. But on coming to look into this development, one began to feel that possibly the mental capacity of the American student would be somewhat overtaxed, and that when he came out into industry, he would have his brain so crammed that he would not really be such a valuable servant to industry as if he had had a simpler education. He (Sir Arthur) had been very pleased to receive from Professor Lewis, of the Massachusetts Institute of Technology, the very comforting remark that the students who had come over from England into his laboratories at Boston made greater progress and in most cases did better work than the American students; and his reasoning was that our training in England was much sounder in its groundwork. Those in industry in this country knew very well that if anybody offered them a graduate from a college or university, they did not immediately say that he was the man they wanted to put in charge of their works. In many cases one looked rather with suspicion on a man who came with high distinctions from a university; and he himself would certainly look with suspicion on some of the people who had come through the course of the American institutions, because he would say that their knowledge was so very technical that they would not be valuable men in his works. After all, when we got down to the bedrock of these chemical engineering problems, they were all capable of fairly simple solution. He had been through quite a large number of new processes and new works; and it seemed to him that success was always based on first principles and common sense. When visiting American institutions he had felt that the Institution of Chemical Engineers must be careful to assist the education of the chemical engineer in this country, in order to see that primarily the curriculum contained that absolutely essential grounding in first principles—in chemistry, mechanics, engineering, and physics, because physics came into the problem just as much as anything else—which was necessary for the making of a first-class chemical engineer. He was appalled when he considered the amount of money spent in America; and in this connection he referred to a publication of the General Electric Company. It was a report on the question of what advantage would accrue to the works by treating coal before its utilization for power purposes. It was a magnificent treatise; and at the end of it was the solution of the problem. He had suggested to the man who had prepared the report that he (Sir Arthur) might be able to guess at the solution; and it actually came down to a matter of the value of the coal. When the coal was highly priced, it was worth while treating it and getting the bye-products out of it before it was used; and his estimation had been within 3 p.ct. of the price of coal at which this would pay. The report was a wonderful piece of work, but he believed that anybody with fundamental training could have got at the solution just as well in a much quicker and simpler manner. They must be British in their training. They had certain attributes which had made them known all over the world. He hoped that the first work of the Council of the Institution would be to form a Committee which would endeavour to lay down, in consultation with the various institutions of the country, a curriculum for the training of the chemical engineer.

## THE USE OF OXYGEN IN GAS-MAKING.

A paper on "Industrial Oxygen" was then presented by Mr. T. Campbell-Finlayson, B.Sc. Considering that the contribution is one of about eighty quarto pages in length, "treatise" is perhaps a better appellation than "paper." It records an investigation into the possibilities of obtaining cheap oxygen; and the plan adopted has been to include all relevant matter and to state clearly the results obtained in the experimental work during the past two years. It is the first contribution to technical literature which deals solely with oxygen; and, as such, the author expresses the hope that it may serve as a starting-point for research.

The following extracts are taken from the summary of the paper and from the section dealing with the economies of gas-making with oxygen.

The work upon industrial oxygen was instituted with the object of finding some simple process which would produce oxygen at a price not exceeding 1s. per 1000 c.ft., and which would involve

low capital expenditure. Before starting experimental work, an extensive search of the literature dealing with oxygen production was carried out. This search did not bring to the notice of the investigators any process of air enrichment which they could accept as a useful line of work. Most chemical processes fail on account of thermal inefficiency. This fault, while tolerable if the oxygen is to be regarded as an expensive chemical, is out of the question from the standpoint of fuel economy.

### Chemical Processes.

The reasons for the failure of the chemical processes are deep-seated, and depend chiefly on the fact that at ordinary temperatures oxygen is very inactive, contrary to the common belief. At high temperatures, oxygen functions as an exceedingly reactive element; and it is safe to say that many processes could be devised which would work at temperatures of 700° C.

The chemical processes for obtaining oxygen which take place at low temperatures are few in number. There are only two which seem at all favourable.

1. Absorption of oxygen by hæmoglobin, the active constituent of the blood of mammals. It is possible that a process might be worked out on these lines; but it seems unlikely that large plants using hæmoglobin could be considered as an adjunct to gas-making. It is therefore felt that for present purposes the hæmoglobin process is not sufficiently attractive.

2. The interaction between nitrogen oxide and oxygen to form nitrogen peroxide. This reaction goes on with great speed at ordinary temperatures; and if a method of isolating the oxygen could be devised when the reaction was reversed, a very simple process would result. Up to the present no method of reversing the reaction, without the intervention of some other working substance involving heat treatment, has been found.

### Physical Methods.

The fact that the chemical processes appeared to be of little use led the investigators to select physical processes of separation, as the heat change in such appeared more satisfactory.

There are a number of physical methods which would result in a concentration of the oxygen in air, the most useful of these appearing to be:

1. Liquefaction, followed by fractional distillation.—This method is in common use; its costs are known; and any development in this line seems to be bound to come from those who are at present utilizing the process. This line of work was not investigated for the above reason, and also on account of cost.

2. Solid adsorption.—The adsorption of gases by some solids is a very remarkable phenomenon which would enable a separation to be effected by a process of fractional heating of the solid. There are great difficulties in the way of this process. The use of charcoal, the cheapest adsorbent, is almost out of the question because of the conversion of the oxygen into carbon dioxide at comparatively low temperatures. The use of other adsorbents, while promising, seems of remote value because of the difficulties of preparing them. These materials are such as silica, gels, and alumina.

3. Diffusion.—There are two types of diffusion which result in separation: (*a*) Diffusion through porous bodies. This is an exceedingly slow and laborious method, depending upon the square root of the densities of the gases. As the densities of nitrogen and oxygen are as 14 : 16, the separation is almost impossible. (*b*) Diffusion through thin films of liquid. This is in certain cases rapid, and results in a separation depending upon the differential solubilities, which is generally more favourable than the difference in densities.

4. Solubility.—Gases have different solubilities; and a process was suggested and tried some years ago for separating oxygen and nitrogen by this means. The original process, which involved compressing air in contact with water—allowing the gas dissolved to escape and re-compressing it a number of times—is useless as a method of procedure. It is too costly in power and plant.

### Pressure Fractionation.

It seemed possible to introduce considerable simplification; and a process which has been named "pressure fractionation" was proposed. This process bears the same relation to the above discontinuous process as intermittent fractional distillation does to the use of a fractionating column. A very complete experimental investigation has shown that the process, which was arrived at from purely theoretical considerations, holds in practice almost exactly; and it is thought that this process is a definite advance on any previous solution process.

The experimental work has shown how very marked is the influence of agitation on the rates of solution, evolution, and attainment of equilibrium between solvent and gas. It has been demonstrated that with certain oils these rates are so rapid that the times involved are measured by seconds. Based upon this fractionation process, a supply of 30 to 40 p.ct. oxygen gas could probably be obtained at a reasonable price, working upon the data already obtained.

The scheme for the fractional process is somewhat as follows: The plant consists of two vessels, each fitted with efficient stirrers and a gas offtake at the top. Each vessel is full of suitable oil, which is maintained in a state of agitation. Air is pumped into No. 1 vessel until the pressure is 135 lbs. per sq. in. Further gas (blow-back gas) is pumped into No. 1 until the pressure is 150 lbs. per sq. in. Vessel No. 1 is thus saturated at 150 lbs. with a gas containing about 22 p.ct. of oxygen ready for the fractionation. The fractionation is carried out as follows, equilibrium being regarded as existing throughout. The pressure is allowed to fall 75 lbs. per sq. in. The gas evolved is passed through the high-pressure blower for the recovery of as much power as possible, and is then blown to waste.

The pressure is then allowed to fall to 36 lbs. per sq. in. through the low-pressure blower (also for power recovery). This second portion is also valueless. The pressure is then allowed to fall to 20 lbs. per sq. in. This gas contains about 25 p.ct. of oxygen, and is compressed and pumped into No. 2 vessel during the solution stage; this being the blow-back gas. The pressure is allowed to fall to 1 lb. per sq. in. absolute; the gas evolved being of the mean composition of 40 p.ct. oxygen. Means will have to be provided for the rapid evacuation of the oil down to this low pressure.

### Economic Considerations.

The main cost of the process lies in the compression of air. Efficient means will have to be provided for the recovery of the power from the compressed air. A study of the economics of the process has shown that it is cheapest to dissolve all the air compressed, and thus start the fractionation with 21 p.ct. in solution. This start is the factor which determines the higher limit for the final oxygen strength. Thus, if we start with 30 p.ct. of oxygen in solution, we should obtain a final oxygen of 60 p.ct. to 70 p.ct. strength.

Various means of obtaining a large supply of cheap 30 p.ct. oxygen have been examined. A scheme which has been called "film filtration," depending upon filmed surfaces, with interior low pressures, has been investigated but has not proved successful.

### Fractionation at Low Temperatures.

A further scheme for improving the pressure fractionation effect, in order to give strong oxygen gas at an economic figure, has been considered. This depends upon the use of methyl or ethyl alcohols at low temperatures as solvents. According to some research it appears that the solubility of oxygen increases with the fall in temperature, while the solubility of nitrogen decreases. In this way the differential solubility becomes greater, leading to a sharper fractionation. As far as the present experiments go, it has been found that there is practically no advantage in carrying out the fractionation at low temperatures. Moreover, alcohol is more expensive than oil, is more volatile, and fractionates less efficiently. This line of improvement by using alcohols has thus been abandoned.

Similarly, experiments on the use of the readily-liquefied gases as solvents for oxygen and nitrogen have also been abandoned, as an examination of the subject shows that any such process could hardly be said to come under the heading of simplicity or cheapness.

## THE ECONOMICS OF GAS-MAKING WITH OXYGEN.

The investigators in this section consider the production of a gas of a calorific value greater than 350 B.Th.U. per c.ft., which figure, it is assumed, approaches the lower limit for economic distribution.

The present methods of producing such a gas are:

1. The carbonization of coal in horizontal retorts.
2. The carbonization of coal in vertical retorts with partial gasification due to steaming.
3. Water-gas processes.

For the production of the maximum number of therms per ton of coal at (say) 450 B.Th.U. per c.ft., coal may be carbonized in horizontal retorts with the production of a quantity of straight gas of high calorific value, and the utilization of some of the coke for the production of water gas in a special producer, finally mixing the straight gas and the water gas in the required proportions to give the 400 B.Th.U. gas. Another method is to carbonize coal in a continuous vertical retort, subjecting the charge to a suitable amount of steaming, by which process a continuous supply of 400 B.Th.U. gas may be obtained.

But neither of these schemes attempts complete gasification. Complete gasification is carried out on well-known lines in modern producer practice, using air-steam blast; but unfortunately the gas so made is overburdened with excess of nitrogen. The object of introducing oxygen into gas-making practice is to allow of the substitution of ordinary recovery producers using oxygen-steam blast for the present system of retorting and subsequent production of water gas. The exact effect of the use of such a process can only be conjectured. According to the calculations of Prof. Cobb and Mr. Hodsman [see "Journal," June 8, 1920, p. 640], by the addition of sufficient oxygen and steam it is possible to gasify coal completely with the production of 69,100 c.ft. of gas of a calorific value of 352 B.Th.U. per c.ft.

Although calculated from quite different data, the figures of Cobb and Hodsman and of Jefferies ["Journal," March 30, 1921, p. 806] may be compared with interest—see next page.

Cobb calculated his results using a coal of lower calorific value per lb. than that used by Jefferies; and although he obtains approximately the same volume of gas, the calorific value of the gas obtained is 352 B.Th.U. per c.ft., as compared with Jefferies' figure of 400 B.Th.U. per c.ft. The quantities of oxygen used per ton of coal carbonized and per 1000 c.ft. of gas made show a slight difference between the two sets of figures; but the most important figure—namely, the volume of oxygen used per therm produced as gas—is practically the same in each case.

COMPARISON OF FIGURES OBTAINED BY COBB WITH THOSE OF JEFFERIES.

TABLE I.—*Showing Data for Complete Gasification, using Oxygen-Steam Blast, as given in the Papers by Cobb and by Jefferies.*

| — | Cobb. | Jefferies. |
|---|---|---|
| Calorific value of coal used per lb., B.Th.U. | 12,730 | 14,240 |
| Gas produced per ton coal, c.ft. at 0° C. | 65,400 | 69,400 |
| Heat value of gas, B.Th.U. per c.ft. | 352 | 400 |
| Oxygen used per ton coal, c.ft. | 12,340 | 14,320 |
| Oxygen used per 1000 c.ft. of gas made | 179 | 206·5 |
| Oxygen used per therm | 51 | 51·6 |
| Steam used, in lbs. per ton of coal | 755 | 672 |
| Efficiency of gas production; fuel for steam being deducted | 90·1 p.ct. | 91·7 p.ct. |

Similarly, the efficiency of gas production is very nearly the same in each set of figures.

The main difference between the two papers occurs in the treatment of the figures for straight gas. The figures obtained by Jefferies appear too high for English coals. He obtains 7 c.ft. of "volatile gases" of a calorific value of 640 B.Th.U. per c.ft. per lb. of coal carbonized. This works-out at 15,680 c.ft. of straight gas at 640 B.Th.U. per ton of coal. Or in other words, Jefferies obtains slightly over 100 therms of gas at 640 B.Th.U. per c.ft. per ton of coal carbonized.

On the other hand, Cobb bases his figures on some experimental work carried out at Uddingston, when straight gas was being made without steaming in Glover-West vertical retorts. His figures appear to work-out at 10,384 c.ft. of gas at 544 B.Th.U. per c.ft. per ton of coal carbonized. This means a production of slightly over 56 therms of gas at 544 B.Th.U. per c.ft. per ton of coal carbonized. The variation between these figures accounts for any variation which may be found in the two sets of calculations. Jefferies considers that the English investigators have made their calculations on an inferior coal; but one cannot help thinking that the figures of Cobb and Hodsman agree more closely with English practice than those outlined by Jefferies. Cobb's data will therefore be used in future calculations.

### APPARENT AND REAL ECONOMY.

It must be remembered that a large production of gas per ton of coal treated may only be an apparent economy. Let us examine the introduction of oxygen first from a thermal point of view. The addition of oxygen would probably not alter the carbonization stage to any appreciable extent, though it would alter the shape of the apparatus in which the carbonization was carried out. The object is to enable one to obtain a more efficient gasification process, in which the blow and the run periods of the water-gas plant both give gas of satisfactory calorific value. Economies are also effected in that the heating is internal rather than external. In an ordinary water-gas plant there is a loss of fuel at the blow stage, even after allowing for the recovery of heat by the waste-heat boilers. According to the Sixth Report of the Research Sub-Committee of the Institution of Gas Engineers, on water-gas production, the efficiency of water-gas production with waste-heat boilers is about 56 p.ct. In the process using oxygen we abolish this loss during the blow period; and if we go in for complete gasification we can get an efficiency of 90 p.ct. The difference between these two efficiencies, ignoring for the moment capital and running costs, gives us the price we can afford to pay for oxygen.

The following figure is obviously approximate, and is open to certain criticisms.

Efficiency of water-gas plant is 56 p.ct.

Efficiency of gasification plant with oxygen is 90 p.ct.

Therefore saving in fuel per 100 tons gasified equals 34 tons.

Oxygen required per 100 tons fuel equals 1,200,000 c.ft.

Price of fuel, say, 25s. per ton.

Therefore price payable for oxygen is

$$\frac{34 \times 25 \times 12}{1200} \text{ d. per 1000 c.ft.}$$

*i.e.*, 8½d. per 1000 c.ft. of oxygen.

From this we see that from a thermal point of view we have 8½d. per 1000 c.ft. of oxygen as a maximum price. There must also be considered capital and running costs. It is suggested that the introduction of the oxygen-steam producer would greatly lower the capital costs for gas undertakings. For this to be the case, the combined cost of the oxygen plant and the gasification plant must be less than the cost of the present plants. The same applies to running costs. The combined oxygen plant and producer plant must employ less labour, &c., than the present plants.

### CONDITIONS TO BE SATISFIED.

From the above remarks it is clear that a complicated oxygen plant would hardly be considered as an adjunct to the average gas-works. In the present case, where the introduction of oxygen is being considered purely as a means of obtaining a higher efficiency, any process for obtaining the oxygen must satisfy three conditions.

1. Oxygen must be made at a cost of less than 1s. per 1000 c.ft.
2. It must require a low capital expenditure.
3. The process must be simple to work.

Before proceeding to discuss whether any of the processes which have been investigated fulfil the above conditions, it must be indicated that the water-gas plant is already an oxygen-making machine. Let us analyze the operations of a water-gas plant. We first take coke and raise the temperature by means of an air blast, giving a reserve of heat which serves to split-up water into hydrogen and oxygen. The oxygen burns carbon to carbon monoxide, but the water-gas plant can undoubtedly be looked on as an oxygen generator—and a fairly efficient one, in that, although we choose to split-up an oxide like water with a high heat of combination, we do actually use both parts of the oxide which is split-up. The water-gas plant is, in fact, an oxygen plant first. The great disadvantage is the lack of efficiency due to the heat carried away in the nitrogen at a high temperature during the blow period.

For the object of improving the efficiency of gas production, we, therefore, require an oxygen process which is better than the water-gas process, and which is not more complicated.

### THE BRIN PROCESS.

At a recent meeting of the Iron and Steel Institute, Mr. Cosmo Johns, in the course of a paper, remarked: "The discarded barium peroxide process must be re-investigated. Its old fault—that it did not give pure oxygen—might prove to be one of its virtues. The working temperature at which with varying pressures it absorbed or evolved oxygen was fortunately within the range of the now available impermeable alloys which resist oxidation. The temperature required could be supplied by the sensible or potential heat of the waste gases in many metallurgical processes. If refrigeration as a method of giving oxygen-enriched air failed, then the barium peroxide process required careful consideration." Mr. Johns was referring more especially to the use of oxygen blast in iron smelting. As regards the use of the Brin process for gas-making, a definite answer may be given. Let us analyze the Brin process. We heat barium oxide to 700° C. and admit hot purified air. We withdraw all the air at this temperature—first the nitrogen and then the oxygen. What have we done that we did not do in the water-gas plant? Nothing, for our waste is still in the hot nitrogen which we could use to generate steam; the final flue gases leaving at the same temperature in either of the processes. There is therefore no saving in the introduction of the Brin process into gas-making. The only method of getting a saving is to devise a low-temperature process involving little power and no heat. The only chemical processes which appeared at all possible on thermal and power grounds—the hæmoglobin and the nitrogen peroxide—fail on account of chemical complication.

### OXYGEN BY LIQUEFACTION PROCESS.

On the physical processes, therefore, efforts have been concentrated. The liquefaction method has up to now failed to produce oxygen sufficiently cheap for its use in gas-making. In a recent paper on the subject of the production of oxygen by liquefaction processes, Mr. K. S. Murray says: In the wider fields of industry where the use of oxygen has often been advocated, as for instance in the enrichment of air for blast furnaces, and in conjunction with steam for the continuous gasification of fuel, it is doubtful whether the stage has yet been reached when oxygen can be produced cheaply enough, even in large plants, to be economically employed."

The pressure fractionation process, concerning which process we are more especially interested, has certain advantages over any other process which stressed the necessity for complete investigation. It is a method which is fundamentally suited for the production of enriched air, rather than pure oxygen; and the less the extent of the enrichment, the cheaper the process becomes. With the chemical processes it is usually more efficient to produce pure oxygen; and with the liquefaction the saving in cost due to partial fractionation of the liquefied air is not very considerable.

### THE EFFECT OF OXYGEN CONCENTRATION.

Cobb and Hodsman made their calculations using 100 p.ct. oxygen. It was thought that it would be interesting to study the effect of the use of varying strengths of oxygen in gas-making (basing one's calculations on their figures) in order to see the minimum strength of oxygen which could be employed to advantage. In the following table the figures for 100 p.ct. oxygen are taken from the paper by Hodsman and Cobb, and the figures for the lower percentages of oxygen are calculated therefrom.

TABLE II.

Column number. For description, see below.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| 100 | 12,340 | .. | 69,100 | 352 | .. | 100 | 147 | 100 |
| 75 | 12,340 | 6,170 | 75,270 | 323 | 8·2 | 87·5 | 118 | 80·5 |
| 50 | 12,340 | 12,340 | 81,440 | 300 | 15·2 | 75 | 95 | 64·5 |
| 40 | 12,340 | 18,514 | 87,614 | 277 | 21·3 | 62·5 | 72 | 49 |
| 25 | 12,340 | 37,020 | 106,120 | 229 | 34·8 | 25 | 24 | 16·3 |
| 20 | 12,340 | 49,360 | 118,460 | 205 | 41·6 | 0 | 0 | 0 |

Column 1. Percentage of oxygen in enriched air used.
" 2. Volume of oxygen used per ton of coal gasified.
" 3. Volume of nitrogen introduced with the oxygen.
" 4. Total volume of gas made per ton of coal.
" 5. Calorific value (gross) in B.Th.U. per c.ft. of gas.
" 6. Percentage of nitrogen in gas made.
" 7. Work done in nitrogen removal, expressed as percentage.
" 8. Increase in calorific value due to gasification with enriched air in place of ordinary air.
" 9. Efficiency of strengthening process—*i.e.*, increase in calorific value over total possible strengthening, at various percentages of oxygen.

The calorific value of the gas per c.ft. using 100 p.ct. oxygen is 352 B.Th.U.; while that of the gas made with 20 p.ct. oxygen (that is to say, air) is only 205 B.Th.U. Over a similar range, the nitrogen content of the gas rises from 0 p.ct. to 41 p.ct.

In removing nitrogen from air, work has to be done. When all the nitrogen has been removed from a volume of air, pure oxygen is left. Thus 100 p.ct. of the work in nitrogen removal has been done. In this connection the important point to remember is that by strengthening the oxygen content from 20 to 40 p.ct., over 60 p.ct. of the total work in nitrogen removal has been carried out.

The object of the introduction of oxygen is largely to obtain efficient gasification with maximum calorific value of the gas. By the use of 100 p.ct. oxygen gas in the blast we obtain our maximum calorific value in the gas made (352 B.Th.U. per c.ft.). By the use of air we get our minimum calorific value of gas (205 B.Th.U.). We may speak of these as 100 p.ct. and 0 p.ct. efficiency respectively. We find that the efficiency of the strengthening of the calorific value does not coincide with the work done in nitrogen removal. Thus, by the use of an oxygen-enriched air containing 50 p.ct. of oxygen we find that 75 p.ct. of the total work in nitrogen removal has been done, yet the efficiency of the strengthening is only 65 p.ct.

Using a 60 p.ct. oxygen, the calorific value of the gas made is 314 B.Th.U. per c.ft. If we use 100 p.ct. oxygen, the calorific value is only 352 B.Th.U. Thus an increase of the oxygen percentage by 40 p.ct. only increases the calorific value of the gas by 11 p.ct. Similarly we are not doing nearly as much work in nitrogen removal by increasing the oxygen percentage from 40 p.ct. to 60 p.ct. as we do in increasing the percentage from 20 p.ct. to 40 p.ct. It therefore appears there will be a limit beyond which it would not pay one to enrich the air. If there is a substantial economy in producing 60 p.ct. rather than 100 p.ct oxygen, then it is certain that 60 p.ct. oxygen would prove more suitable for the economic production of gas. For strengths of oxygen below 60 p.ct. there does not appear to be very much demand in gas making.

When we examine the pressure-fractionation process, we find that there is every reason to believe that 40 p.ct. oxygen could be produced along such lines. But the method rapidly becomes more inefficient when we try to make 60 p.ct. or 70 p.ct. oxygen. As has already been explained, efforts to make this process give a supply of strong oxygen gas at an economic figure have up to now failed.

We are therefore driven to the conclusion that no process has yet been devised which will give large supplies of oxygen by a simple process at a price not exceeding 1s. per 1000 c.ft.

### Discussion.

The PRESIDENT said that the investigation described in the paper was undertaken at the instance of the Woodall-Duckham Vertical Retort and Oven Construction Co. (1920), Ltd., of which he was Chairman. The Company considered that, if industrial oxygen could be obtained at 1s. per 1000 c.ft., it would be of the utmost value to industry. Therefore, they had got Mr. Finlayson to carry out research work. A laboratory was provided for him; and he was left severely alone for as long a time as he wished to be, reporting at odd times and receiving suggestions or decisions as to the line which his research should follow. The result of the research was that the firm did not proceed with the idea of the commercial manufacture of oxygen. However, the information obtained was well worth the money paid for it, and further, they had had the great pleasure of working with Mr. Finlayson. The members were all very obliged to him for having given them a clear résumé of a lengthy and, in some respects, rather complex paper. This résumé would make them wish to read the paper and to study it closely; and, from what he himself knew of the paper, it would repay anybody interested in this class of work to do so. In remarking on the paper, there were two names which he would like to mention. This oxygen research was really due, on the part of the Company that did it, to the earlier work of Prof. J. W. Cobb, of Leeds University. Prof. Cobb and the Company had had long discussions on this subject; and Prof. Cobb's previous investigations had led the Company to do the work. The second name was that of Mr. J. Stanley Morgan. Mr. Morgan was Technical Director of this work, and had given Mr. Finlayson a great deal of assistance; and it must be recognized that many of the ingenious methods of absorption, and mechanical details, as well as other details, were due to Mr. Morgan. He (the President) was certain that Mr. Morgan's work was very valuable. Referring to the paper, the President said he would certainly call it a first-class one. It dealt with a type of work which was of interest to all of them, and a type which they wanted to see developed. There were the chemical, the physical, the electrical, and the mechanical aspects of the affair; and Mr. Finlayson had to be a mechanical engineer, an electrical engineer, a chemist, and a physicist. This went to show, once more, that if we were to get really first-class industrial work on the lines of chemical engineering, a training in these basic professions was essential for any man who was going through with it. The only other point he would make was that this research was never intended to be a research on the obtaining of pure oxygen. It was a research for the strengthening of the mixture of oxygen and air, and that was all; and, so far as the research was concerned, the Company would have been perfectly contented to have a satisfactory method of obtaining a mixture of oxygen and nitrogen containing from 50 p.ct. to 60 p.ct. of oxygen.

Dr. R. LESSING congratulated the Institution on having had a paper of this kind giving the results of some of the most valuable research work. Whatever their result, from the point of view in mind, the data contained in the paper would be very valuable for future use. Could the author say to what extent the solvents were vaporized and carried away with the concentrated gas? Particularly in the case of paraffin oil, one would imagine that a certain amount of hydrocarbon vapour was carried out with the gas. The Chairman had pointed out that the idea never had been to make pure oxygen; and he took it that in cases where the oxygen might have been used for gas-making purposes, such a vaporization of oil would not be a disadvantage, provided the economic value of it could be realized again in gas form. The fact that oxygen up to 40 p.ct. strength in a mixture could be obtained—and no doubt this had been considered by those making the research—might be of value in certain gas-making processes, as, for instance, in producer-gas practice. Had it been considered whether the process would be of advantage in making a gas of a higher calorific value from producer or Mond gas plants? Another point was whether there would be any advantage in using the process as a preliminary to pure oxygen making, taking the process mentioned in the paper, in which a concentration up to 40 p.ct. could be obtained, with low pressure, as a first stage before the high-pressure process in Linde fractionation was employed.

Mr. DAVID BROWNLIE, after congratulating the Institution on the quality of its first paper, said the point that interested him was in connection with producer gas and water gas. He would assume for the moment that it was possible to make oxygen at a price of 1s. per 1000 c.ft., because he felt that some day somebody would find the method of doing it at this price. But assuming this, what was the advantage? In the producer or water gas process, one of the curses was the ash of the coal. When the producer-gas process was first invented by Bischoff, followed by Sir William Siemens, coke was used with a very low draught; and this was done quite well. But as soon as the draught was increased, the trouble of molten ash in the producer commenced. This was the curse of the whole process. If they intended to increase the oxygen in the air blast, they would enormously increase these troubles of the ash. The first trouble would be increased coking, to say nothing of increased wear and tear of the firebrick lining. He admitted that if the oxygen in the air blast was increased, it was also possible to increase the steam; but this was a delicate operation. Producer-gas plants in this country were generally worked on the crudest lines. It was well known, for example, that in water-gas production, roughly one-third of the fuel was used in the blow in order to increase the temperature of the fuel bed for the run. It was common practice in this country for people to be actually burning more of the fuel in the blow periods than in the run itself, because they would not go to the slightest trouble to control the blast. If the oxygen was increased, this trouble would be increased considerably. The paper stated that the efficiency of a water-gas plant was 56 p.ct., and that if oxygen was used, the efficiency of the gasification plant would be increased to 90 p.ct.; but he was not clear about this. In the first place, he did not see why the author should take the ordinary water-gas plant, which, in any case, was getting out of date. It was true that if they took the ordinary water-gas plant and wasted the blow gases, the efficiency would be 55 p.ct.; but people did not do that to-day. Any self-respecting man used the blow gases partly for generating steam; and it seemed to him, therefore, that it was hardly fair to take the efficiency of the water-gas process at 56 p.ct. Moreover, water-gas was being used more and more for heating purposes, and they should therefore take, as well, the hot-gas efficiency. Surely the interest of the oxygen question was not in the old-fashioned water-gas plant, but in the modern gasification processes. There were, of course, a large number of total gasification processes on the market, such as the Tully, the Moore, &c.; and the general principle was simply a small vertical retort on the top of the water-gas plant, the coal being partially carbonized by the sensible heat in the blow gases. This partially-carbonized fuel descended in the final portion and was subjected to ordinary water-gas process; and the mixed gas was obtained. But surely they were not going to say the efficiency of this process was only 56 p.ct. Speaking from memory, the efficiency was about 72 p.ct.; and he could not conceive how oxygen was going to help. There was a still further process which was coming forward which was yet more important, and this was to combine the total gasification process with low temperature—*i.e.*, to take these processes and subject the coal, as it descended in the vertical retort, to regulated low-temperature carbonization. This was a much more efficient process; and the efficiency would probably be in the neighbourhood of 80 p.ct. He did not see how oxygen was going to benefit here; and if the author could explain this, he would be grateful. Now he came to another point—CO poisoning. They had all heard a good deal about this in the Press; and he must say he thought the Press were right. In the old days of the gas process, in the prehistoric time of about 1820, they used to get a gas with about 6 p.ct. of CO. It was called a straight gas. Then in 1889, the water-gas process was introduced; and the percentage of CO was increased to about 15 p.ct. To-day, he supposed it could be said that ordinary town gas was 75 p.ct. straight gas and 25 p.ct. water-gas, with from 15 to 22 p.ct. of CO; or in the case of steaming in vertical retorts, the CO was from 15 to 20 p.ct. There was a great deal of difference of opinion about this. If oxygen was used, then immediately the CO would be increased. He took it that they would all admit this; and therefore they were coming to the point whether they could use town gas with 25 to 30 p.ct. of CO. He foresaw serious difficulties. There were about 300 people committing suicide every year by sticking their heads into gas-ovens. They went to the most elaborate precautions to prevent buying two or three pennyworth of poison at the chemists' shops, and yet supplied it *ad lib* in the kitchen. This question had to be thoroughly investigated; and there was no doubt that there was going to be serious trouble. The point was that with the use of oxygen the percentage of CO would be still further increased; and he foresaw gas being supplied with 35 p.ct.

The PRESIDENT, replying to Mr. Brownlie on the question of carbon monoxide, said that in America practically the whole gas supply was water gas; and they seemed to thrive on it. It was better and cleaner to use gas than to commit suicide by other means. Of course, the agitation in the Press on carbon monoxide had introduced this method to the would-be suicide, and had made it much more popular.

Dr. GOODWIN (Canada), in congratulating the Woodall-Duckham Company on having given permission for the publication of the research work, said that it would be preferable if more companies published results. In connection with carbon monoxide in gas, he referred

to his own experience on the other side of the Atlantic, where he lived for some years. There the gas contained 25 to 30 p.ct. of carbon monoxide.

Mr. C. S. GARLAND said there was another aspect of the matter which Mr. Finlayson had raised, and this was that in air there were two other gases for which substantial uses had actually been found—namely, argon and neon. It was probable that the demand for these two gases would increase; and, therefore, any process for the splitting-up of air would become of still greater importance. In 1913, experiments were being made in Berlin on the use of oxygen for lighting the streets—in conjunction with the zirconia filament which was heated by a mixture of gas and oxygen—with a view to using up the excess of oxygen which the Osram Company expected to have in connection with their experiments on the half-watt lamp. It indicated one possible use for large quantities of oxygen. He was in entire disagreement with Mr. Brownlie with regard to the use of oxygen. He had had, at different times in his experience, the problem of raising relatively small bodies to a high temperature quickly. He was not at all sure that he would have put as low a limit as 1s. per 1000 c.ft. on the value of even 25 or 30 p.ct. oxygen, not so much for the increased temperature itself which one could obtain, but in view of the fact that the increased temperature would reduce materially the time factor. He believed that in this connection it would be found that air containing 25 or 30 p.ct. oxygen would be of very great advantage in many industries. What he had found so delightful about Mr. Finlayson's paper was not only the scientific and experimental work dealt with, but the fact that the economics of the problem were set out so fully.

Dr. R. LESSING said there was one point he would like to mention, because Mr. Brownlie's remarks should not be allowed to go out uncontradicted with the authority of the Institution, and get into the Press. He (Dr. Lessing) did not see why in a water gas made with oxygen, which would allow, of course, the water-gas process to be gone through as a continuous process (which was the main advantage of it—even granted that the presence of oxygen would lead to a higher temperature) it should produce a higher percentage of carbon monoxide in gas. At the same rate at which carbon monoxide would be made, hydrogen would be made; and therefore all it could do was to reduce the quantity of carbon dioxide, which nobody wanted.

Dr. E. W. SMITH said it might be useful to give some general idea as to what the Woodall-Duckham Company had in mind when they started this research; but before doing this he would like to deal with the point raised by Mr. Brownlie as to carbon monoxide. Mr. Brownlie had indicated that he was a believer that the future was with the Tully process and low-temperature carbonization—using this expression to cover the process generally, there being, of course, more than one system. Presumably, low-temperature carbonization would give a very high calorific value gas of small volume, which would enable the Tully gas to be enriched from any complete-gasification plant. Did not Mr. Brownlie see that this very trend of being able to utilize complete-gasification gas by mixing it with a very rich gas, meant that they would be able to use still more complete-gasification gas, and that therefore the carbon monoxide would be still higher than in any gas produced at present? Personally, he thought it would be a fine thing, because it had not yet been shown that there were fewer deaths through suicide or through accident in districts like that of the South Metropolitan Gas Company, where they were producing 6 p.ct. of CO, than there were in districts where they were using up to 25 p.ct. of water gas, and in which there was, perhaps, 12 p.ct. of CO. He did not know of any town in the country where at the present time there was more CO in the gas than there was before the war. The whole of the trouble of CO poisoning could safely be put down to the publicity given to the excellent means for suicide provided by coal gas or town gas as such, and not because of the CO in any way. He did not believe that even Mr. Brownlie would suggest that coal gas with the CO taken out of it would be quite innocuous. Mr. Brownlie wanted a reply to the question, "Why do we desire to use oxygen in gas production?" His Company tackled this question solely from the point of view of the production of cheap gas. In these conditions, oxygen at more than 1s. per 1000 c.ft. would not be attractive. There were outlets for oxygen of 25 and 30 p.ct. purity which would stand a price of 2s. 6d. and even 4s. per 1000 c ft. One such use in industry was for blow-pipe work or for furnace work of a special kind. Another outlet that was being considered was in hospitals. If they had the facilities for pumping air containing 25 p.ct. oxygen through the wards where chest troubles were being treated, it would have an enormous advantage in speeding up recovery. To return to the question of gas-making, not only would it be possible to save the great bulk of the heat which went away with the blow gases, but there was a bigger gas production, a bigger therm production, and a more highly efficient operation altogether. The only reply that was effective to Mr. Brownlie was that his Company and Professor Cobb and Mr. Jefferies (of the Jefferies-Norton Company) had calculated—and they agreed fairly well—that the efficiency of a continuous gasification plant in which the coke was gasified as well as the volatile matter, was as high as 90 p.ct. They had considered that the three things to be aimed at in any gas-making proposition were higher thermal efficiency, lower capital costs, and lower labour costs. It was felt that by the use of oxygen it would be possible to erect plants which would be run in such a way that the actual cost per therm, taking into account these three factors, would be such as to make it very attractive to the gas industry. Mr. Brownlie was worried about the effect of very high temperatures of ash. He would like to show Mr. Brownlie producers working with 80 p.ct. of ash in the coal or coke and with less than 5 p.ct. of carbon in the ashes—and working much more satisfactorily than most producers in ordinary working conditions at the present time. It was possible to liquefy the ash and to have a producer working at 85 p.ct. over-all efficiency, and obtain a gas of from 130 to 140 B.Th.U. per c.ft. But Mr. Brownlie himself had given the reply. It was not at all necessary to have these high temperatures inside the generator. By the judicious use of steam—which was not a thing which had to be controlled within 1 or 2 p.ct.—the temperatures in the generator could be kept down, just as they were in the Mond recovery plant or recovery plant of any kind. He did not think there was much point in going into further details. The research was started from the point of view of the production of cheap gas. The first thing his Company did was to consult with Mr. Murray, of the British Oxygen Company; and they obtained all the information available in connection with the liquefaction and the Brin processes. Both of these were turned down because they were prohibitive from the point of view of gas production; and then Mr. Morgan had suggested the solubility process. The whole of the work was prompted by the paper which Prof. Cobb had presented to the Institution of Gas Engineers; and this paper contained all the calculations necessary to convince Mr. Brownlie that it was an economic proposition to use oxygen in gas production if the oxygen could be obtained at 1s. per 1000 c.ft.

Mr. FINLAYSON, replying to Dr. Lessing's question as to the loss of paraffin oil, said he had found that the quantities could not be estimated. He had tested the fact that the gas coming off was not explosive. This was important. They intended to use the enriched air for gas manufacture; and even if they carried through a slight trace of paraffin, it would not be a very serious thing. With reference to the question as to whether it was a preliminary for pure oxygen processes as they exist, of course this was not a question for them to settle.

A hearty vote of thanks was accorded to the Woodall-Duckham Company and Messrs. Finlayson, Smith, and Morgan, who have been concerned with the research.

In the evening there was an informal dinner at which there was a short discussion upon the training of the chemical engineer.

## ROADS AND TAR.

### A Non-Technical Appreciation.

It is refreshing to read a non-technical appreciation of an inestimable boon which the gas industry has conferred upon the community. We refer to an article which appears in the May issue of a small magazine bearing the title "Impressions." How often one hears that a certain road is best because it is "a good tarred road all the way." The writer in "Impressions" suggests that there is something very significant about such a phrase, because "it makes one think not only of roads, but of tar, and the particular attributes of tar when applied to a road."

It has often occurred to us that one of the factors which militate against the gas industry lies in its inherent good manners. It has been trained, so to speak, in an atmosphere of solid worth. It is conservative and ultra-refined. While knowing its good qualities, it expects too much of the public who, alas! do not worry to trace the benefits showered upon them to their proper source. No particularly elastic imagination is required to visualize a motorist who, after enjoying a spin on a good road surface, returns home, sinks into an armchair, and dilates upon the gas industry, which he fondly imagines to be in a state of senile decay. He has not forgotten about the road surface, for the simple reason that he has never thought about it. What layman connects the absence of dust with the efforts of the gas industry? The question immediately arises as to whether he is to be blamed if he has never had the opportunity of acquiring the information without the expenditure of effort. To-day life is lived faster than when the gas industry was born; and however wonderful the present achievements may be, they will not be recognized unless they are shouted blatantly from the housetops. This policy is not a nice one admittedly, and is contrary to the sensibilities of worthy gas-makers; but the fact remains that one must either shout or disappear. Surely a moral of no mean significance is pointed when it is left to one unconnected with the industry to draw attention to the potentialities of tar. This fact, however, enhances the value of the article, and is an ingenuous confession of the security of the gas industry and its service to the community.

We may quote with advantage one or two passages from the article to which reference is made: "The mere mention of tar compels one to thoughts on what soon proves to be a most fascinating scientific subject. Within a comparatively few years one of the most despised bye-products became one of the most valuable of commodities. . . . One cannot think of tar without endeavouring to investigate it—to find out just what part it has played in our lives. Tar distillation has to-day reached a point which our greatest scientists could not at one time visualize in their own wildest dreams. Fullest credit must be given to them for their researches, but I am quite sure they were originally inspired by laymen. The preservative qualities of tar were disclosed to them by laymen. . . . I can certainly join with thousands, and I might almost say millions, of those who help to make up what is known as the general public, in appreciating the comfort of travelling on a good tarred road. . . . If I may use a metaphor, it gives a road a nice complexion. Throughout this country there are gas-works and coke-ovens which give satisfaction to the road user. I know of nothing which can beat a combination of British brains, British stone, British cement, British grit, and British tar." The corollary to this is, of course—and British gas-works.

**The Standard Cooker.**—The first specimens of the standard cookers are at present on view at the offices of the National Gas Council, No. 28, Grosvenor Gardens, S.W. A number of these standard cookers has been ordered by the Council so that gas undertakings may have an opportunity of purchasing samples for testing purposes. Applications for samples may be placed immediately; but it is not expected that the cookers will be ready for at least three months.

# "N.P.K." FERTILIZER.

By E. Lloyd Pease, of Darlington.

This fertilizer, containing nitrogen, phosphates, and potash, is produced in the process of scrubbing gas for ammonia. As the result of a good deal of experimenting, the method described in the following notes has been developed up to a small commercial scale. By this process the ammonia is extracted, and by the same operation becomes a constituent part of the mixed fertilizer ready for use.

To be efficient, fertilizers must contain phosphates and potash, in addition to nitrogen in the form of ammonia. Also the ingredients must be so intimately mixed that every minute plant-rootlet is able to draw upon all three constituents. It is to achieve this as far as is possible that intricate mixing appliances have been developed. When it is remembered that in 100 parts of a mixture four parts of potash have to be evenly distributed among 96 other parts, it is clear that some rootlets must inevitably go short, even if every care is taken in mechanical mixing. I claim that in my process this point is largely met, and that it also provides a cheap and effective way of extracting ammonia from gas.

The following is a brief description of the process, the plant, the efficiency, and the chemical aspect. Three-fourths of ammonium sulphate—namely, the sulphuric acid radicle—is not only useless for manurial purposes, but may be actively harmful. If, therefore, another vehicle can be substituted, much may be gained. In my process, by the use of phosphoric acid, the vehicle itself provides essential manurial properties. Not only so, but, as will be shown, it has a higher fixation value for ammonia than is possessed by sulphuric acid. In the process under review, only a crude acid which is easily extracted from phosphate rock or superphosphate is required. Having obtained crude and dilute phosphoric acid, there may be added to it the desired percentage of sulphate of potash; the solution then being mixed into a finely-ground material such as coke, shale, peat, clay, &c., so that a damp product is produced. When this acid base is brought into contact with gas containing ammonia, the latter is completely extracted and combined as di- or tri-ammonium phosphate. The base material emerges from the plant as a dry fertilizer containing all the manurial ingredients required, and in such proportions as may be arranged.

The value of the fertilizer as it emerges is not only the market value of the ingredients as three chemicals, but as a mixed fertilizer in a ready-to-sow form. Its value is increased by the following characteristics:

(1) Through being mixed by solution and direct impregnation by gas instead of by mechanical means.

(2) Through being a neutral, or, in the case of tri-ammonium phosphate, a basic fertilizer, in contradistinction to the acid mixtures based on ammonium sulphate and superphosphate.

(3) Through a large proportion of the phosphoric acid being in the form of water-soluble phosphates which will not revert in the soil, in ordinary conditions, to insolubility.

These advantages apply to all the absorbent bases named; but when peat is used there are important further points to be noted. Peat supplies the organic element found in the straw of farm and stable manures, which are now becoming very scarce; and it also contains organic nitrogen, which is available for plant use over a prolonged period after the ammonia introduced by gas treatment has been absorbed. The fertilizing value of organic nitrogen is placed by authorities at a higher figure per unit than its equivalent in added $NH_3$—in this way, to a large extent, meeting the cost of the peat.

## Plant.

The apparatus required is extremely simple; and that so far used leaves little to be desired. It consists of a trough containing a worm for mixing the base with the acid, and a revolving tube in which the material and the gas meet in contra flow. The existing plant was erected chiefly to confirm on a commercial scale the absorbing efficiency of the acid material obtained in smaller experiments. It is installed at one of Messrs. Pease and Partners' coking plants, and receives gas after it has been stripped of tar, and therefore of a considerable part of its ammonia. It was not easy to provide a large pipe connection; and that used, which delivers about 13,000 c.ft. per hour, has proved much too small. It has therefore been impossible to determine the output of which the tube is capable. It is about 15 ft. in length by 2 ft. 6 in. in diameter.

The efficiency with which it treats the gas received is at least as high as that attained by other processes, as is indicated by the following figures, which show the results obtained.

| | $NH_3$ in Gas. Grammes Per Cub.Metre. (Inlet). | $NH_3$ absorbed in Shale. | $NH_3$ in Gas. (Outlet). | Efficiency. P.Ct. |
|---|---|---|---|---|
| Shale | 5·75 | 1·972 to 4·012 | 0·011 .. 0·017 | 99·8 .. 99·74 |
| | $NH_3$ in Gas. Grammes Per Cub.Metre. (Inlet). | $NH_3$ absorbed in Peat. | $NH_3$ in Gas. (Outlet). | Efficiency. P.Ct. |
| Peat | 5·75 | 1·16 .. 7·21 | 0·015 .. 0·109 | 99·74 .. 98·00 |

Apart from other valuable features possessed by the new fertilizer—such as neutrality or basicity in place of acidity, and impregnation in place of mechanical mixing—it is produced by a considerably less expenditure of acid than the equivalent mixed fertilizer formed of super-phosphate and sulphate of ammonia. As an illustration, 60 tons of acid, when employed to produce ammonium phosphate through phosphoric acid, will produce the equivalent fertilizer product to 100 tons used in making super-phosphate and sulphate of ammonia separately. Put another way, if, instead of treating a given quantity of phosphate rock with 2 parts of $H_2SO_4$ to produce superphosphate, 3 parts are used to produce phosphoric acid, a volume of acid results equal in ammonia fixation—*i.e.*, when taken to the stage of tri-ammonium phosphate—to the total of the $H_2SO_4$ used, besides containing in soluble form the phosphates present in the rock treated and usually represented by superphosphate. This is shown by the equations relating to the production of ammonium phosphate by the new process, and ammonium sulphate and superphosphate separately representing a similar manurial value by the older practice.

Chemical Reactions showing Economy in Sulphuric Acid.

New Process:

$$Ca_3(PO_4)_2 + 3H_2SO_4 = 3CaSO_4 + 2H_3PO_4$$
$$2H_3PO_4 + 6NH_3 = 2(NH_4)_3PO_4 \text{ (tri-ammonium phosphate product principally formed).}$$

Old Process:

$$Ca_3(PO_4)_2 + 2H_2SO_4 = \underbrace{Ca(H_2PO_4)_2 + 2CaSO_4}_{\text{Superphosphate.}}$$
$$6NH_3 + 3H_2SO_4 = 3(NH_4)_2SO_4.$$

It will be seen that in the proposed process 3 molecules of sulphuric acid are used to obtain 6 molecules of combined $NH_3$ and 2 molecules of soluble phosphate. On the other hand, superphosphate and ammonium sulphate made independently require 5 molecules of sulphuric acid for the same result.

This may be developed by the following equations:

$$2NH_3 + H_2SO_4 = (NH_4)_2SO_4.$$
34 parts of ammonia + 98 parts of sulphuric acid = 132 parts of sulphate of ammonia.

$$Ca_3(PO_4)_2 + 2H_2SO_4 = Ca(H_2PO_4)_2 + 2CaSO_4.$$
310 parts of phosphate rock + 196 parts of sulphuric acid = 506 parts of superphosphate containing 196 parts of phosphoric acid.

If the same quantity—*i.e.*, 294 parts of $H_2SO_4$—are used in the new Pease process, the following results are obtained:

$$Ca_3(PO_4)_2 + 3H_2SO_4 = 2H_3PO_4 + 3CaSO_4.$$
310 parts of phosphate rock + 294 parts of sulphuric acid = 196 parts of phosphoric acid + 408 parts of calcium sulphate (discarded).

$$2H_3PO_4 + 6NH_3 = (NH_4)_3PO_4.$$
196 parts of phosphoric acid + 102 parts of ammonia = 298 parts of tri-ammonium phosphate.

From this it appears that by using the same quantity of sulphuric acid in the Pease process as in the old method (namely, 294 parts) there is a gain, as compared with the latter, in the fixation of 102 parts of ammonia as compared with 34 parts—a saving in acid of 66·6 p.ct. This is effected through the sulphuric acid functioning in the treatment of phosphate rock, and in producing phosphates in the acid form, which in turn fix ammonia.

If the process is stopped at the "di" stage, the quantity of fertilizer produced would contain 196 parts of phosphoric acid and 68 parts of ammonia, as against the same phosphoric acid and 34 parts of ammonia in the usual conditions of separate manufacture. A saving of 98 parts of sulphuric acid out of 196 normally required to fix 68 parts of ammonia—or a 50 p.ct. saving—is achieved.

If the base material used is free from lime, all the phosphates resulting will be water soluble and immediately available for plant support when they are dissolved out of the peat, shale, coke, &c., by rain. Any acid-soluble phosphate required may be added to the material before treatment in the form of finely-ground phosphate rock, or in other suitable form. It should be noted that in this process there are no effluents; and no steam or power is used except that required for the mixing trough and revolving tube.

From careful observation it has been ascertained that, in normal conditions, ammonium phosphate is stable in peat up to at least the tri-ammonium basic stage, and that a certain excess of $NH_3$ may be held mechanically. But where contained in shale, coke, burnt clay, &c., the di-ammonium, or neutral, is the permanent stage. By this process, for which patent protection has been obtained, a non-acid mixed fertilizer is produced by direct treatment of the gas, thus eliminating, on the one hand, all washing of gas for ammonia and subsequent treatment of liquor, but also, on the other, the cost and labour involved in storing and mixing fertilizers. It is anticipated that the "N.P.K." fertilizer so produced at a gas-works will find a ready market among horticulturists and allotment holders in the vicinity; the base, or fixing material, being coke dust, with or without the addition of peat (moss litter), bone dust, &c., or other useful absorbent. "N.P.K." of higher concentration may be produced by a second treatment of the base with acid and gas; but the strength usually required

is within the range of once-treated coke—viz., 4 to 6 p.ct. $NH_3$ and 12 to 18 p.ct. $H_3PO_4$ and $K_2O$ as required. Taking the higher values for these figures, and remembering that the value of phosphoric acid is to that of superphosphate as 1½ : 1, it will be seen that 1 ton of "N.P.K." of this strength is equivalent to 21 cwt. of superphosphate and sulphate of ammonia mixed together, with the further advantages, as above mentioned, of non-acidity, solubility, and impregnation. If peat moss litter is used, double this weight equivalent can be secured. The concentration is then double that obtainable by other means, and is too strong for undiluted use.

The equations in this statement have been provided by Dr. D. Tyrer, to whom I have been greatly indebted throughout the investigations.

## LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

### Summer Meeting at Southend.

In response to the announcement of the Hon. Secretary of the Association (Mr. George Winslow) that the President (Mr. D. Cleave Cross, of the Lea Bridge District Gas Company) and the Council were anxious that as many members as possible, accompanied by ladies, should avail themselves of the opportunity offered to visit a first-class and efficient works, there was a very large muster at Southend last Saturday, on the occasion of the summer meeting. Seemingly, this year, June has comparatively little to offer in the shape of pleasant weather; and Saturday morning promised none, even of this little. However, well before the time (2.30) fixed for assembling, on the Eastern Esplanade, at the works of the Southend Gas Company—which had been thrown open for inspection—the sun had made its appearance; and, with a very few short intervals, it continued in evidence until long after the proceedings had concluded. The visitors were received at the works by Mr. Thomas F. Canning (the Engineer and Manager); and, after being photographed, were formed into parties for the tour of inspection, which was carried out under the guidance of Mr. Canning, Mr. R. G. Clark (Assistant Engineer), Mr. W. G. Cousins (Chemist), and Mr. R. Lilly (Works Foreman).

This is the second inspection of the works which has taken place within a period of two months—the first having been by the Eastern Counties Gas Managers' Association, in April—and on each occasion appreciative remarks have been made on the means adopted by the Engineer and his Directors (under the chairmanship of Mr. John H. Burrows) to meet the rapidly increasing demand for gas. The Company have a history which goes back nearly seventy years, gas having been first lit in the town on May 8, 1855. From small beginnings, the undertaking has attained a state of great prosperity; there having been of recent years an enormous growth in the sale of gas. The total figure, which was only 45 million c.ft. in 1895, had increased to practically 400 million c.ft. in 1915. Since that time the Company have purchased the Rochford Gas Company's undertaking, and the Leigh Gas-Works of the Southend Corporation. The total sale of gas of the combined undertakings amounted for the year 1922 to 795 million c.ft. Such an accession of business as is here indicated has naturally entailed a great deal of hard work on the part of those responsible for the maintenance of the gas supply. As the Chairman of the Company himself declared recently, the Company owe very largely to Mr. Canning, not the need for gas, but the fact that they are in a position to supply this need.

Early in the tour, the different parties were taken along the Company's pier, which passing high above the esplanade extends from the works a hundred yards into the sea, and accommodates sailing barges of 250 tons. At the end of this pier, the coal is unloaded from the barges by crane and grab, which discharges into a hopper. From this hopper the coal is loaded into trucks, which are then drawn by small steam locomotives along an elevated railway to the stores, where it is tipped immediately above the breaker-pits of the elevators. Gas oil is received at the pier, and pumped direct into storage tanks on the works; while coke, tar, and liquor are also loaded into barges.

#### Holder Foundations on Marsh Land.

Much interest was manifested in the foundations for the new 2½ million c.ft. spiral-guided holder (in steel tank), which had been far advanced since the time of the visit of the Eastern Counties Association. This holder is to be completed in the summer of 1924, and is being made and erected by Messrs. Samuel Cutler and Sons, Ltd. With the new holder in operation, it will be possible for the Company to store 3,800,000 c.ft.

There was no question, Mr. Canning explained, of putting in a masonry tank, owing to the nature of the soil. It is marshy land—as a matter of fact, land which in the days gone by (perhaps he should say in the ages gone by, because it was very long ago) formed possibly a part of the estuary of the Thames. It was alluvial soil. In these circumstances, a masonry tank would have been too costly by far; and even had it been put down, there would have been a question as to whether it would prove water-tight and stable. Therefore there was nothing for it but to provide a steel tank; and again, owing to the nature of the site, it was not possible to put down an ordinary raft foundation without danger of its tilting—which would have been a great risk. When arranging for the erection of a structure such as this, which—for holder and foundations—was going to cost probably between £60,000 and £65,000, it was imperative to give serious thought to the foundation on which it would rest. The existing holder is on piles, as are most of the heavy buildings about the works. The experience of a former Engineer in the building of a retort-house had shown the treacherous nature of the soil. When the first portion of the retort-house was built, it was not put on piles, but merely on a mass concrete foundation; and subsequently the Company had to incur the expense of cutting holes through this concrete, driving piles through the holes, and filling-in again.

After considering the various means available, it was decided to put down pitch-pine piles for the new holder. There are 870 of these piles, of an average length of 34 ft. In consequence of the soil being a mixture of clay and sand, called "clyte," which shrinks when it gets dry, the raft had to be in the form of a ribbed floor, which will stand when the clay shrinks away from it. When the holder is completed, each pile will be carrying about 30 tons; the weight of the holder, tank, and water coming on the concrete being something like 24,000 tons.

#### About the Works.

In the retort-house are two benches of six beds of eleven horizontal retorts, 24 in. by 16 in. by 21 ft. long, charged and discharged by a Fiddes-Aldridge machine. Eight-hour charges of 10 cwt. are worked. There are three sets of carburetted water-gas plant by Messrs. Humphreys and Glasgow—one of a capacity of 1,250,000 c.ft., and two of 900,000 c.ft. a day. In the governor-house are two pressure-raising fans, of 500,000 and 750,000 c.ft. per hour; the former being employed for feeding the eastern and east-central parts of the district, and the latter the west-central, western, and Leigh portions. Crossley gas-engines generate the electric power for driving these fans. Two Bryan-Donkin compressors, of 50,000 c.ft. capacity each, pump gas at a pressure of 5 lbs. per sq. in. into the west-central and north-eastern portions of the district. They also supply gas for high-pressure lighting.

#### Tea.

After the round of the works, there was a move to the Palace Hotel, where the party, numbering some 185, sat down to high tea as the guests of the Chairman and Directors of the Gas Company—Mr. Canning occupying the chair.

The President remarked that when Mr. Canning went to Southend the works were very different from what they were to-day. The Company had to deal with a district which was extending with great rapidity. In fact, he believed that at the present moment Southend was growing faster than any other town in England; and this had been reflected in the business of the undertaking, which had practically doubled since 1914—and mainly in the last four or five years. It was a great strain on those who had the administration of gas-works to cope with 20 to 25 p.ct. increase in output; and he would say that Mr. Canning had had one of the most awkward jobs of any gas manager in England. What Mr. Canning was doing was to meet increased demands by increased efficiency. It was easy to increase one's output if there was plenty of money to draw upon; but without this, the only thing was to increase the efficiency of the plant. This was what Mr. Canning had been doing during the past three or four years. He had been steadily increasing the efficiency of the whole of his works; and at the same time he had been adding to and modernizing his plant as opportunity occurred. The new holder was an example of this. The members of the Association had had during the present session the good fortune of seeing two gasholders under construction. At Lea Bridge, the riveting of the tank plates was in progress; and at Southend they had seen the foundations being prepared. What Mr. Canning was doing—building a 2½ million c.ft. holder on marshy land—was one of the most trying things, from an engineering point of view.

Mr. F. A. Frost (South Metropolitan Gas Company) was sure he was voicing the opinion of all of those present when he said they greatly appreciated the facilities the Company had afforded the Association and their lady friends for visiting the gas-works that afternoon. To many of the older members of the Association—of which he happened to be one—the day had been of additional enjoyment by reason of the fact that it had enabled them to renew acquaintance with Mr. Canning, who had been a member of the Association in those early times when it was in a far different position from that which it occupied to-day; and the present position was due to men like Mr. Canning, who did yeoman work in the early days of the Association. He was going to ask them to pass a very hearty vote of thanks to the Directors of the Gas Company for their permission to visit the works and for the generous hospitality extended to the members—coupling with the vote the names of Mr. Canning and his assistants, who had done so much to make the visit interesting.

Mr. F. J. Pearce (North Middlesex Gas Company), who seconded, said they had had a good day in every respect. They would all go away having gained useful information. It did not fall to the lot of every gas engineer to have to construct a 2½ million c.ft. holder on marshy land; and when Mr. Canning had his new holder successfully completed, he would have done something of which he might justly feel proud.

Mr. Canning assured the members, on rising to acknowledge the vote, that it had given both his assistants and himself the greatest pleasure to show the members over the works; and his Chairman and Directors had been equally pleased to invite the Association to Southend. The proposal to include ladies in the party had met with the hearty support of his Board, and particularly of the Chairman. At one time he (Mr. Canning) enjoyed the privilege of membership of the Association; and he was delighted to see among those present a number of those who were also members at the period to which he referred. It was very nice after all these years to see them again, and

brought back happy memories of similar days to the one they were now enjoying. Looking back, he fully appreciated that in the work he had had to undertake since he left the Association, he had derived the greatest possible assistance from the meetings, papers, and visits in which he had then participated. It was true that he had had difficulties to contend with since going to Southend. When he first went there, it was an old works, burdened with a heavy capital charge. It was more or less an old works now; but he was happy to say that it had been much improved, and the capital stood at about £700 per million c.ft. of gas, as against £1000 or over at the time of his appointment. It had been a question, as Mr. Cross had pointed out, of endeavouring to get greater efficiency out of the plant—a matter to which they could not give too much attention, if they wished to bring down the price of gas. Working on the therm basis, efficiency was bound more and more to come to the fore as time went on. If they were getting better efficiency at Southend—and he believed they were—it was greatly due to his staff, who were splendid workers, and did their very best in the interests of the undertaking. It was impossible to operate gas-works now as was done in the old days. He would have much pleasure in conveying the vote of thanks to his Directors, who would be glad to learn that the members had shown appreciation of the invitation by turning up in such large numbers.

PERSONAL.

Before the members dispersed, to spend the remainder of their wholly successful day in Southend as might please them best,

The PRESIDENT made two announcements of a personal character. He remarked that there was among them that afternoon an old friend who had been at death's door for many weeks. He referred to Mr. F. Ainsworth, one of the originators of the Association, whom they were delighted to see again hearty and well. Also, that day was the last of official duty of Mr. Winslow, who had been their Hon. Secretary for no less than seven years. He had done extraordinarily good work for the Association; and for this they tendered him their warmest thanks.

The new Hon. Secretary of the Association is Mr. Leonard Lacey, Assoc.M.Inst.C.E., Gas Light and Coke Company, Gas Works, Bromley-by-Bow, E.

## GAS IN JAPAN.

JAPAN has a flourishing gas industry, quite equal to the European standard, up-to-date, well managed, successful, and supplying the continually increasing demands and wants of a huge industrial population. Japan is made up of three large islands and over 400 small ones. It has an area of 146,000 sq. miles—three times the size of England—and a population rapidly approaching 60,000,000, compared with 38,000,000 inhabitants in this country. There are no less than 46 towns in Japan with populations exceeding 50,000 persons, in all of which gas for lighting, heating, cooking, and power has a large field. The capital, Tokyo, with all the amenities, institutions, and buildings of a European or American capital, has nearly 2¼ million inhabitants. The second largest town, Osaka, contains 1,260,000 inhabitants; and there are four other towns with populations of over 400,000. Clearly, once gas has been introduced, there exists almost an unlimited opening for its development.

Coal is a native product; and Japanese coal mines have had a maximum output of 31,271,000 metric tons, and could no doubt increase this. In Japan gas is extensively used for power, more especially in textile factories and for weaving; the increase for these purposes having been notable. As recently as 1911 there were only 956 gas-engines at work, with an aggregate output of 24,625 H.P. The most recent official returns—those for 1920—show an increase within the decade to 2368 engines with an aggregate of 67,272 H.P.—a highly satisfactory record. Many industries use gas-engines, the more important including chemical factories, ceramic works, food and drink factories, breweries, rice and flour mills, printing and publishing works, bamboo and wood works, and, of course, the gas industry itself.

Gas-works employ over 2800 operatives. The most recent official figures state that the number of gas companies in Japan is 76, with a paid-up capital of £13,410,150 ($64,368,720). There are 1,217,094 instalments of lighting, and 965,213 for heating. The quantity of gas supplied has steadily increased year by year, as shown by the following figures:

| | Cubic Metres. | | Cubic Metres. |
|---|---|---|---|
| 1914 | 142,638,942 | 1918 | 224,229,497 |
| 1915 | 150,840,904 | 1919 | 261,369,707 |
| 1916 | 153,905,000 | 1920 | 275,210,682 |
| 1917 | 185,247,968 | | |

These figures show that the output has been practically doubled within seven years. With regard to coke and tar, the production of the former has increased from 328,425 tons in 1914 to 469,118 tons in 1920, and the output of coal tar from 262,034 hectolitres in 1914 to 289,278 hectolitres in 1920.

**Smoke Abatement.**—In the "JOURNAL" for May 23, the report of the Public Control Committee of the London County Council, dealing with atmospheric pollution and smoke prevention, was summarized. This report, which came before the Council yesterday, states that the problem of smoke abatement has now become so acute that a well-thought-out and properly co-ordinated solution is long overdue. Emphasis is given to the vast proportion of smoke produced in the domestic grate; and the gas-fire is suggested as a remedy.

## RESEARCH SUB-COMMITTEE OF THE GAS INVESTIGATION COMMITTEE OF THE INSTITUTION OF GAS ENGINEERS.

### The "Fairweather" Recording Calorimeter.

EIGHTH REPORT.

(*Concluded from p.* 679.)

APPENDIX 2.

*Gas Control.*—In the body of the report attention has already been called to the desirability of certain alterations to the gas system of the "Fairweather" Recorder. The following are additional points:—

1. There is frequently difficulty in illuminating the sight-box of the meter and the thermometer and it is often necessary to use tapers when observing them. We have consequently lined the underside of the meter-housing with sheet asbestos, which may be a desirable addition to other instruments.
2. A cock might be added corresponding to our cock (g) (fig. 1, "JOURNAL," Vol. CLXI., p. 464) for determining inlet meter pressure, preferably on the meter inlet pocket.
3. As originally supplied, we found leakage of gas at the plugs which give access to the valves at the base of the governors. Leaks here are somewhat inaccessible and difficult to locate.
4. From time to time it is necessary to remove with blotting paper accumulations of oily matter which gathers on the diaphragm leathers of the governors and appreciably alters their loading, and hence the pressure which they permit at inlet meter.
5. It is found that there is a small cyclical fluctuation of pressure as the drum of the meter revolves. This makes it desirable to always make pressure readings at the same point in a revolution. The pointer is at present friction-tight upon a round spindle. There would be some advantage in so shaping the end of the spindle and the pointer socket, that the pointer could only be mounted in one position relatively to the drum.
6. Some trouble has been experienced with gas leakage between the burners and the steatite head of the calorimeter burner. The cement used, apparently plaster of Paris, does not make a good joint, and we have used litharge and glycerine successfully.

*Water Control.*

1. The distributing cone below the cup might be larger, as a certain amount of water is splashed down the spindle into the oil chamber, especially when the cup is riding high for low tabular numbers. More effective guarding of the float spindle is necessary.

*Tabular Gauge.*

1. There is some doubt as to the manner in which the water runs down the outer surface of the air chamber, and it is quite possible that it follows stream-lines rather than forming a uniform film over the whole surface. Under such circumstances the exchange of heat between the air in the chamber and the water will be slow, and reliance must be placed upon conduction in the walls of the chamber as well as through them for bringing the whole structure to a uniform temperature. We therefore suggest attaching to the outer surface of the chamber a stout wire arranged as a continuous spiral of 3 or 4 ins. pitch soldered to the chamber at intervals. This would prevent the water following in a direct path from top to bottom down any one side, and incidentally would render more certain the action of the space between the air chamber and the outer case as an air-saturator.
2. The tabular gauge and its scale are constructed of brass and in less than a month the scale became illegible in the gas-works' atmosphere.

   It is therefore suggested that the plan we have found successful might be adopted, and that the graduations and figures be cut a little more deeply and be filled in with colour, the scale then being heavily lacquered with shellac or celluloid varnish. As an alternative an aluminium scale might be tried, but gilding or silver or nickel plating would be no improvement

upon brass. Frequent cleaning is objectionable from the risk of damage to the recorder which it involves. The gauge could be better illuminated and more accurately read if the back as well as the front of the brass guard tube were cut away if this would not render the tube undesirably weak. We have found it an advantage to cover the top of the tabular gauge with a loosely fitting brass cowl to exclude dust and occasional splashes of water. As certain dimensions for setting are quoted to the centre line of the gauge block this might be with advantage marked on the block, or distances be given to its upper face instead of centre line.

3. The specific gravity of the oil used in the apparatus has an important influence upon the shape and dimensions to be given to the float chamber, but a variation of 0·05 in specific gravity will not introduce a greater error than ± 0·1 p.ct. at the ends of the tabular gauge. As alternatives the makers suggest gas oil or a mixture of paraffin and machine oil, but do not state a specific gravity they recommend.

As a matter of convenience our instrument was set up with gas-oil of specific gravity 0·862 at 60° F. The oil was carefully distilled rejecting all coming over below 200° C. and subsequently filtering the remainder through filter paper.

Despite this treatment the gas-oil has thrown down a sludge in the bottom of the oil chamber which if it accumulates may block up the communicating oil passages. We therefore recommend the discontinuance of the use of gas-oil for this purpose.

4. Inasmuch as the pressure of the gas at inlet meter in our tests has been approximately 0·9 in. water gauge, a correction has always been applied for this in making control tests on the non-recording portion of the instrument, and the tabular gauge should be set to read 0·002 above the value given by direct observation of barometer and meter thermometer. This point is dealt with more fully under the heading of gas control.

*Circulating System.*—The following points are concerned mainly with details of execution, rather than the general scheme of the circulating system, and suggest some desirable alterations for future instruments:

1. There seems to be no sound reason why the various overflows should not discharge directly into the tank, being clipped to the top angle-iron. This would dispense with the receiving pocket at the right-hand side of the tank and with several minor fittings.
2. The engine is fastened to a wooden framework with fairly substantial clips. As these, however, were holding on to the very light metal stamping which forms the base plate of the engine, the construction was very flimsy. We have removed the rubber feet and bolted the legs of the engine tripod directly to the wooden framework and the construction is much more rigid. The substitution of a metal for the wooden stand is worth consideration.
3. A mica window might be put in the copper chimney for the inspection of the engine burner as regards centreing and size of flame.
4. The small set-screws holding the clutch castings to the pump and engine shafts, are too light for their work, and have a tendency to slip.
5. There is a certain amount of unavoidable leakage from the glands of the pump, which is increasing with wear; originally half a gallon per day, the leakage has now risen to about 5 gallons per day. This is an inconvenience, as with the present construction the leakage falls on to the floor.

   If, however, the pump were mounted over the tank on a bracket or cantilever bolted to the present engine and pump framework, such leakage would fall directly into the tank, and an even greater leakage would be of no consequence. The shaft between engine and pump would require to be made slightly longer than at present.

   The latter construction would also render the pump more accessible, the present arrangement involving an undesirable amount of dismantling to get at the pump when this requires attention.
6. As already noted, the suction valve of the pump requires redesigning. As alternatives, it might also prove of value to instal a rotary pump (not centrifugal) or a larger reciprocating pump geared down from the engine to secure slower and quieter running.
7. The delivery of the pump is at present through a length of ½ in. rubber-lined canvas hose, which takes up the "hammer" of the pump to some extent. This hose is scarcely desirable in a permanent installation, and a metal pipe with a more orthodox method of eliminating "hammer" is to be recommended.
8. It would be desirable to have the suction of the pump removed to a point as remote as possible from any of the return-flows to the lower tank, and particularly that of the water-cooler.
9. The overhead tank could with advantage be made at least 50 p.ct. larger, and would act even more efficiently as a temperature equalizer than at present. The working depth of water in the existing tank could be increased by nearly 2 in., and it is quite clear that the capacity of the overhead tank alone governs the reserve of water available for running the recorder when the pump fails, and not the total water in the circulating system. At present the reserve of water in the overhead tank represents about 5 mins. supply.
10. The original valve for controlling the town water supply would not hold against the town pressure, and at our suggestion has been replaced by an ordinary ½ in. ball-cock valve slightly modified to work in conjunction with the counterpoised bucket and acts quite satisfactorily.
11. The disadvantages of the evaporative cooler have already been discussed. The presence of the bare iron legs in the galvanized iron tank encourages rusting and the use of iron tacks for securing the lead trays to the backboard is also causing rapid rusting. The tacks have disappeared. The use of lead trays does not seem to be particularly satisfactory, as they distort rapidly under the influence of the vibration set up by the pump, and consequently makes it difficult to maintain a desirable action of the water in dropping from tray to tray.

    The greater part of the cooling takes place on the upper trays, but we have rarely found the water leaving the bottom tray to be closer than 4-6° C. to the main body of the water in the tank. This water from the cooler floats as a warm layer upon the surface of the water in the tank, and further evaporation and cooling takes place there, which points to the inadvisability of covering in the tank so long as this system of cooling is retained.
12. It is suggested that experiments might be made with a surface condenser fed with water from the town supply. From preliminary experiments we have made, not less than 10, ½ in. copper tubes in parallel, 30 in. long, would be required and special arrangements would have to be made for the reception of the water at the calorimeter end, to prevent air-locking and flooding. The consumption of water would not be so great as for the whole apparatus using town water direct and the effects of such fluctuations as did occur in the temperature of the cooled water would be minimized by the fact that the cooled water was mixing with a much larger bulk in the tank, and that in any case only about one-fifth of the circulating supply would be affected. Condensers in duplicate with a bridge pipe would enable cleaning of one without interruption of operations.

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**South Metropolitan and Brentford Price Reductions.**—From the date of reading the meters for the quarter ending Midsummer, the price of gas supplied by the South Metropolitan Gas Company will be reduced from 9d. to 8½d. per therm. The Brentford Gas Company announce a further reduction in the price of gas from 11d. to 10·2d. per therm for the Michaelmas quarter, and a further 0·4d. for the Christmas quarter.

**County of Lanark (Middle Ward) Gas Price Reductions.**—The prices of gas in the districts supplied from the Uddingston gas-works have been reduced as from May 15 as follows: In the Bothwell and Uddingston district from 2s. 6d. to 2s. 3d. per 1000 c.ft.; in the Bellshill district from 5s. 3d. to 3s. 4d.; in the Holytown district from 5s. 10d. to 3s. 9d.; and in the Larkhall district from 6s. 3d. to 3s. 9d. per 1000 c.ft. The price of gas in the district supplied from the Cambuslang gas-works has been reduced from 4s. 7d. to 4s. 5d. per 1000 c.ft.

# CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

## Therms per Ton.

SIR,—I cannot fully accept Mr. Ibbs's correction, as it does not allow the minimum value for the 1·08 gallons of oil per 1000 c.ft. of water gas, which would only leave 69·18 therms per ton, not the 70 he claims. But I must correct my figures for his Company and the Commercial Company, who produced 69·1 therms per ton. Both these are close to the coveted 70, which takes some doing!

I too hastily concluded that, as in my own practice (apart from war and idiotic coal strikes), carburetted water gas would be used to maintain the quality, not lower it, as, except in a factory furnace, I am not in favour of it, useful though it be for capital and emergency service. This must be my excuse for putting the two erroneous results before your readers.

While writing, I see the announcements of the future raising of the declaration values of two of the most important Suburban Companies. I am sorry to lose the evidence they both afford at present of costs and conditions attaching to the 460 B.Th.U. standard which I have always been assured fully satisfied the consumer—which, after all, is the point of aim, as our sliding-scale dividend depends on it. In former letters I have commented on the absence of uniformity at starting, but thought the irregularity between the standards of apparently uniform undertakings would at least give us valuable indications for our guidance. We started with a difference 450 to 500. Now that we are to have 470 to 560, and perhaps higher, which way does truth lie, and will the consumer be better pleased with the higher standard when he finds that on his meter he is to pay a higher price? We shall see before we follow!

H. E. JONES.

*Palace Chambers, S.W., June 17, 1923.*

## Oxygen Plants for Small Works.

SIR,—I read with some interest references in the "JOURNAL" to the question of oxygen production for carbonization or complete gasification. I take it for granted that the reference to the capacity of 1,000,000 c.ft. oxygen plants is a daily, and not an hourly, capacity; the latter being the standard adopted in this country. But with water power available for the running of such plants, the cost figures, although they sound utopian, do not appear to us altogether impracticable. We have never studied this problem from the point of view of the big gas-works in this country; and I think it would be rather an interesting matter to get the view of the big gas producers on the possible application of such a system.

On the subject of oxygen developments, up to now the Old World has been substantially in advance of our American cousins—a position which one would like to see maintained. In the continuation of your references, you allude to the French view supported by "Industrial Gases" that the small plant is impracticable [see "JOURNAL" for May 30, p. 530]. So far as this may have reference to such schemes as are in use at big gas-works, we are at one with them; but we entirely disagree with this view for any fair-size oxygen consumer. Our experience, in fact, is quite to the contrary. Practically every individual consumer of oxygen from (say) about 25,000 c.ft. per week upwards, can instal his own plant with very substantial savings for himself, which are the greater the further he is removed from the nearest existing oxygen plant.

The manufacture of oxygen can no longer be described as a complex or difficult task; and it is our experience that unskilled labour can be very successfully trained in the efficient running of such plants.

LIQUID AIR LTD.,
O. SIMONIS, Managing Director.

*Queen's Park Works, 111, Salisbury Road, N.W. 6, June 12, 1923.*

## Pitch Prices.

SIR,—In your issue of June 13, the following particulars are given, under the heading of "Current Sales of Gas Products"—

| | | | |
|---|---|---|---|
| Pitch.—East Coast | . . . . . | 115s. to 120s. | f.o.b. |
| ,, West Coast Manchester | . | 112s. 6d. to 117s. 6d. | ,, |
| ,, ,, ,, Liverpool | . . | 113s. 6d. to 118s. 6d. | ,, |

In the issue of "The Colliery Guardian" for June 15, the following prices are indicated—

| | | |
|---|---|---|
| Pitch.—f.o.b., East Coast | . . . | 142s. 6d. |
| ,, f.a.s., West Coast | . . . | 142s. 6d. to 147s. 6d. |

Market reports which indicate such a wide difference in price cannot be reliable.

SETTLE, SPEAKMAN, & CO., LTD.,
per W.H.J.

*Alsager, Stoke-on-Trent, June 18, 1923.*

[We cannot take any responsibility for prices quoted in a contemporary.—ED. G.J.]

**Profits and Charges at Huddersfield.**—The minutes of the last meeting of the Huddersfield Gas Committee showed that the income for the twelve months ended March last was £315,178, and the expenditure £246,155, yielding a gross profit of £69,023, which, after allowing £38,049 for payment of interest and sinking fund, left a net surplus of £30,974. This was carried forward to the depreciation and contingencies account. At the same meeting, the price to be charged during the ensuing year was considered; and it was decided to reduce the price of gas through ordinary meters to 3s. 2d. per 1000 c.ft., less 5 p.ct. discount. Also the charges for meter-rent were to be discontinued from April 1 last. An additional penny in the shilling was allowed to slot-meter users; and the rebate allowed on certain quantities of gas consumed for any purpose was doubled.

# REGISTER OF PATENTS.

## Portable Atmospheric Gas Stoves.—No. 196,758.

ARTHUR SHAW & CO., LTD., and ROSE, C. E., both of Willenhall.

No. 6012; March 1, 1922.

This invention has relation to portable atmospheric gas-stoves which embody supports for the articles to be heated, and which are adapted for connection to a flexible tube leading to the gas supply; and it has for its object a simple and convenient construction which will enable the flame to be distributed.

The burner head is in communication with a single mixing conduit, and an incurved or concaved truncated conical cap resting on the top of the burner head partially extends into the mixing chamber, and is secured to the base of the burner head by independent means, such as an upwardly extending screw pin. The upper edge of the burner head is provided with convex serrations or flutings, which, in conjunction with the incurved or concaved sides of the cap, form burner orifices.

## Automatic Safety Gas-Cock.—No. 196,820.

EDMEAD, F., and STREETE, A., both of Brighton.

No. 12,614; May 4, 1922.

This invention relates to an automatic device to prevent an accidental flow of gas in the event of the cock being left open, and the gas supply being resumed after temporary cessation. It is primarily intended as a safeguard against accidents arising out of the use of prepayment meters.

According to the invention, a pressure-actuated cut-off valve is provided in the supply system, in conjunction with a chamber which acts as a pressure accumulator; and mechanical means are incorporated whereby when the valve is closed it cannot be opened save by the pressure in the accumulator acting on one area of the valve and the pressure in the feed pipe acting on another area of the valve. The co-operation of both pressures is necessary before it can be opened. When the valve is once opened, both areas can be acted upon by the pressure in the feed pipe, and it is kept open. The valve may close either in normal working, as when the cock is turned off, or by a failure of the gas supply. The device was fully described in "THE GAS SALESMAN" for June, 1922, p. 79.

## Gas Water-Heaters.—No. 197,071.

GOAD, G. A., and PROCTOR, W. F., both of Richmond, Surrey.

No. 4592; Feb. 16, 1922.

This invention relates to gas water-heaters of the kind comprising a boiler having a draw-off cock, a valve-controlled water inlet, a gas-burner arranged thereunder, and a gas-control valve operated by the pressure of the steam in the boiler.

The patent covers the construction, and the combination with the heater, of the gas-control valve, which comprises a cylinder in communication with the steam space of the boiler and having two passages through its wall, one communicating with the gas supply and the other with the gas-burner, a piston in the cylinder having a groove as a connecting passage between the gas supply and the burner, and spring means acting on the piston. The cylinder space above the latter forms an air cushion for the piston.

## Vertical Retort-Settings.—No. 197,193.

TOOLEY, G. W., and WEST'S GAS IMPROVEMENT CO., LTD., both of Manchester.

No. 13,221; May 10, 1922.

This invention has for its object to provide improved heating arrangements of vertical retorts for the distillation of coal, shale, and other carbonaceous materials.

In accordance with the invention, the retorts are arranged with a series of superposed horizontal combustion chambers round them; the chambers at one side of the retorts being separate from those at the other side, so that the flame and combustion products which pass through the combustion chambers in series in a zig-zag path travel in parallel streams at the opposite sides of each row of retorts. The combustion chambers communicate with one another alternately at the front and back of the setting. Producer gas is admitted to the bottom combustion chambers at one end, and a supply of secondary air is admitted adjacent the gas-orifice. A further supply of secondary air is admitted, at the opposite side of the setting, to the upper part of each transfer passage between two intercommunicating superposed combustion chambers. At the producer side of the setting further supplies of producer gas and secondary air are admitted to the upper of the two combustion chambers intercommunicating at that side. This arrangement of alternate combined gas-and-air admission passages is continued up the retort; but adjacent the top the horizontal chambers merely circulate the products of combustion round the retorts, so as to give the contents of the latter a preliminary heating.

## Gas-Flow Regulators.—No. 197,159.

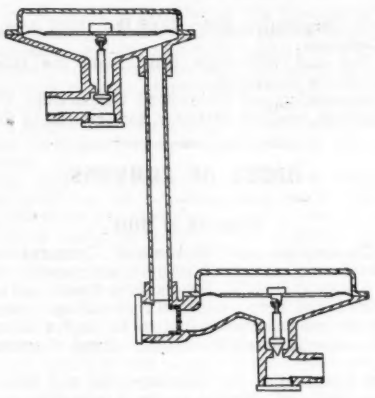
STEWART, J. G., of Letchworth.

No. 9793; April 5, 1922.

This invention relates to gas-flow regulators of the pressure governor and orifice type, for maintaining a constant rate of flow of a gas, whatever its specific gravity.

Regulators of this type are mainly used to regulate the flow of a combustible gas to a burner. The patentee states that in such regulators errors are found in the pressure governors, particularly when these are of the diaphragm type, due to the necessarily small forces

available to operate them. Other errors are introduced by the suction at the burner, and by the viscous resistance to the flow of gas in the passages between the pressure governor and the burner. According to the present invention, two pressure governors, acting differentially, are used, permitting the use of higher pressures in the governors and so increasing their accuracy. Further, the error caused by burner suction is eliminated, and the length of passage effective in offering viscous resistance to the flow of gas is diminished.



A Flow Regulator (J. G. Stewart, of the Sigma Instrument Company).

The invention comprises (as may be seen from the elevation reproduced) first, a pressure governor of the usual type, in which a fall of pressure in the governor chamber produces an opening of the valve; secondly, a pressure governor of the escape valve type, a rise of pressure in the chamber of which causes the opening of a valve and the escape of gas from the chamber; and, thirdly, connecting the chambers of the two governors—a passage restricted anywhere in its length by an orifice of suitable dimensions. The outlet governor is situated at a lower level than the inlet governor; and the inlet governor is adjusted to maintain a pressure equal to that in the outlet governor *plus* the pressure due to a column of air in a normal state and of a height equal to the difference in level of the two governors, with the addition, (if necessary) of a small pressure to overcome viscous resistances and factors neglected in the accepted theory of orifice flow. When these conditions are satisfied, the pressure drop in the orifice will be that necessary to maintain constant volumetric flow from the inlet governor through the orifice to the outlet governor.

## Valves for Purifiers, Condensers, &c.—No. 197,343.

WILLIS, J. H., of Birmingham.

No. 23,460; May 27, 1922.

This invention relates to improvements in valves for checking the flow of air and gases, more particularly for use in connection with gas-mains or installations such as purifiers, condensers, and the like. It concerns the liquid-sealed type, in which the valve is in the form of a hood or flanged disc, the depending flange of which, when the valve is closed, is immersed in an annular chamber filled with mercury, so that a perfect closure is obtained.

The object of the invention is to provide an improved form of valve by which any tendency for the sealing liquid to be displaced by the pressure of the gas before the lower edge of the flange is adequately sealed is overcome; and with this object in view the invention essentially consists in providing an inwardly projecting lip or flange round the upper part of the sealing chamber, with which the side wall or flange of the valve makes sliding contact, so as to form a closure as the lower edge of the flange enters the sealing liquid.

The face of the flange which engages this lip is preferably slightly tapered or chamfered off, so that the closure does not come into operation until the lower edge of the flange enters the sealing liquid. An external gauge may be connected to the sealing liquid, so that the level on each side of the valve can be ascertained at a glance, and it can readily be seen if the valve is properly closed or if any leakage of the air or gas is taking place.

The specification also describes means for emptying or filling the sealing chamber, and the special type of valve chamber which is preferred.

## Atmospheric Gas-Burners.—No. 197,182.

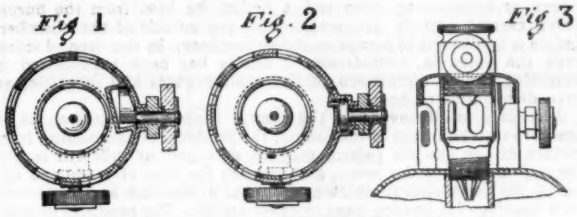
GLOVER, W. R., and THOMAS GLOVER & CO., LTD., both of Edmonton, N. 18.

No. 11,830; April 27, 1922.

This invention relates to that class of atmospheric gas-burners in which the mixing chambers are surrounded by perforated casings provided with hit-and-miss air regulators.

A particular construction of such devices is claimed and fully illustrated by drawings, of which we reproduce fig. 1, a horizontal sectional plan of the burner looking upwards, and in which a cam is employed on the button stem, the air holes being open; fig. 2, a similar view to fig. 1, but showing an eccentric pin connected to a disc on the button stem, instead of a cam; and fig. 3, an elevation, part broken away, of a burner for inverted atmospheric gas lighting, and showing the connection to the globe carrier and mixing tube.

The ordinary holed mixing chamber is employed, surrounded by an inverted cup-shaped device, the wall of which surrounds the mixing chamber. The cup is secured to the nipple block between the joints of the mixing chamber and an enlarged portion of the nipple block. It is provided with a series of holes and also a gland socket, through which is passed a stem having on one end a turn button, while the end inside the cup is provided with a cam-shaped block (fig. 1) or a disc carrying an eccentric pin (fig. 2).




Atmospheric Burner Control (Thomas Glover & Co., Ltd.).

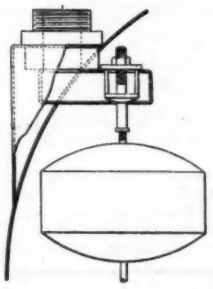
Inside the cup is positioned a cut spring sleeve having a series of holes corresponding to the holes in the cup, and also a recessed portion or slot enclosing the cam or surrounding the eccentric pin respectively. The mixing chamber carries the globe holder which engages the bottom of the cup-shaped device, so that the latter is closed to the atmosphere except by the holes.

## Wet Gas-Meters.—No. 197,259.

METERS, LIMITED, of Manchester, GLOVER, W. T., and BERRY, J., both of Oldham.

No. 26,994; Oct. 5, 1922.

This invention, relating to wet gas-meters, has for its object to adapt such meters in a simple and convenient manner for the effective measurement of gas which may vary in pressure over a considerable range. It combines, with the gas inlet of a wet meter, a double-seated or double-beat float-controlled shut-off valve having seats of differential areas arranged so that the pressure of the gas supply will not tend to close the valve or interfere with the rise and fall of its attached float.



Modification of Wet Meter Inlet Valve (Meters, Limited).

The drawing illustrates the arrangement, it being understood that the meter is provided with the well-known float displacer for maintaining a constant water level, and with other ordinary fittings forming no part of the present invention.

The inlet communicates with a valve chamber having a pair of valve-ways in which seat the faces of a double-beat valve connected to the float. The upper valve-way is rather larger than the lower valve-way; and by such differentiation in size the tendency of the pressure of the gas acting on the upper valve exceeds the tendency of the same pressure acting above the lower valve. When the water in the meter falls below the appropriate working level, the weight of the float will close the valve and maintain it closed against the pressure of the gas supply in the valve chamber. When the water is raised to the required level, the weight of the rising float will be withdrawn from the valve; and the latter will be opened without obstruction, but rather assistance, from the gas pressure due to the differentiation in the sizes of the valve-ways.

## Guide Carriages for Spiral Gasholders.—No. 197,508.

CUTLER, S. & E. E., both of Millwall.

No. 10,984; April 19, 1922.

This invention is for improvements in or relating to guide carriages for spirally guided gasholders, and relates particularly to that type of guide carriage having slot-hole adjustments between the carriage and the holder and between the roller-supporting brackets and the carriage, whereby adjustment of the guide rollers in both radial and tangential directions of the holder is permitted.

The specification refers to Messrs. Cutler's "Steel-All" guide carriage, describing which an illustrated article appeared in the "JOURNAL," Vol. CLVIII., p. 507.

The patentees claim:

1.—A guide carriage having slot-hole adjustments for the carriage or the roller-supporting brackets, or both, characterized by grooves or serrations on a movable part which engage corresponding grooves or serrations on a part which is fixed against movement in the directions in which adjustment of the movable part is permitted, the said grooves or serrations being transverse to the major axes of the slot-holes.

2.—The combination of a sole-plate having slot-holes to permit of its adjustment in a direction tangential to the tank or holder to which it is secured, and two or more roller-supporting brackets secured to the sole-plate, the brackets each being provided with slot-holes to permit of adjustment towards and away from the centre of the gasholder relatively to the sole-plate and independently of the like adjustment of its companion.

3.—A guide-carriage wherein the sole-plate and roller-supporting brackets are each provided with grooves or serrations transverse to the major axes of the respective slots, which engage corresponding grooves or serrations provided on parts fixed against movement in the directions in which adjustments of the sole-plate and brackets are permitted.

4.—In a guide carriage according to any of the preceding claims, a roller-supporting bracket (constituted, for example, by a steel forging) having the roller axle formed integrally therewith.

### Gas Cooking-Stoves.—No. 197,543.

MARWOOD, F. T., of Pleasington.

No. 13,737; May 16, 1922.

This invention relates to gas-stoves for cooking purposes in which a burner is disposed between two chambers which may comprise two ovens, or between an oven and a boiler, the heat from the burner being carried entirely or partly round the outside of the chambers before it is allowed to escape to the atmosphere. In this type of stove, says the patentee, considerable difficulty has been experienced in obtaining proper circulation of the heating gases and in getting an even distribution of heat.

According to this invention, the central burner is situated above an aperture in the bottom of the casing, the products of combustion from certain of the gas-jets (which may be arranged at different levels) passing up between the ovens, and between the tops of them and the top of the outer casing, which constitutes a hotplate and is formed with openings for heating pans or other vessels. The products of combustion pass away through apertures in the end walls of the outer casing. The products of combustion from the remaining gas-jets pass between the bottom of the ovens and the bottom of the outer casing. One or more gas rings and a griller may be placed above, or to one side of, the stove for heating water or other liquid quickly, and for grilling purposes. The burner is formed with a V-shaped centre piece, so that an equal supply of gas and air will be delivered to the burner nozzles at each side of it.

## APPLICATIONS FOR PATENTS.

**[Extracted from the "Official Journal" for June 13.]**

Nos. 14,585 to 15,153.

BOWATER, N. J.—"Distillation of fuels." No. 14,710.
BRICKWOOD, J.—"Device for lighting gas-stoves, &c." No. 14,620.
CLARKE, F. D.—"Combined lighting and heating burner." No. 14,922.
COKE AND GAS OVENS, LTD.—"Methods of extracting hydrocarbons from coal gas, &c." No. 14,754.
COOK, E.—"Valves and cocks for gas-burners." No. 14,641.
DONOCLIFT, R. J.—See Brickwood, J. No. 14,620.
FUEL RECOVERY SYNDICATE, LTD.—See Bowater, N. J. No. 14,710.
GAS LIGHT AND COKE COMPANY.—See Cook, E. No. 14,641.
GEORGE, LTD., W. & J.—"Gas furnace." No. 14,806.
HEDLEY, T. J.—See George, Ltd., W. & J. No. 14,806.
HELPS, G.—"Gas-burners." No. 14,894.
HEYL, G. E.—"Distillation of oil, shale, coal, &c." No. 14,923.
JOHNSTON, A. G. KENT.—"Means for lighting, &c., street gas lamps." No. 14,677.
KIDDER, F. R. J.—"Gas-taps." No. 15,146.
MACKIRDY, W.—"Gas-turbines." No. 14,782.
RICE, J. V.—"Gas-actuated rock drills." No. 14,748.
SELWOOD, J. J. J.—"Self-sealing gas-retort door." No. 14,813
STILL, C.—See Coke and Gas Ovens, Ltd. No. 14,754.

**Barnsley Gas Prices.**—At a meeting of the Barnsley Town Council, the Mayor (Alderman S. Jones), replying to a question regarding the price of gas, said they were arranging to meet the Directors of the Gas Company shortly, with a view to securing a reduction of the charge.

**Gas Poisoning.**—At the Hove Town Hall on June 8, a verdict of "Death by misadventure" was returned on the body of Mrs. M. Fitzgerald, aged 90, who had been found sitting close to an unlit gas-fire. In the medical evidence, Dr. Jeffries stated that the appearances pointed to asphyxiation rather than coal-gas poisoning.

**Limerick Gas Price.**—The Limerick Gas Committee have intimated to the Corporation that when their new plant has been installed at the works, they will be in a better position to state when a reduction in the price of gas may be expected. Requests for a reduction have been frequently made, and have been a subject of discussion at the Corporation meetings.

**Cheaper Gas in Dundee.**—The price of gas in Dundee is to be reduced 3d. per 1000 c.ft. to both domestic and power consumers. This will make the price to ordinary consumers 3s. 6d., to prepayment consumers 3s. 9d., and for power purposes 3s. 3d. to 2s. 10d. per 1000 c.ft. Somewhat higher charges are levied in Invergowrie, Midmill, and Baluniefield.

**Fire at Shoreditch.**—Some days ago a fire destroyed three floors of Messrs. T. Nicholson and Sons' factory in Holywell Row, Shoreditch. The fire, which started on the top floor of the building, is believed to have been due to the fusing of an electric motor. Efforts were concentrated on preventing the flames from spreading to a large cabinet works adjoining the burning building.

**Gas Installations on the Becontree Housing Estate.**—In June, 1921, the London County Council decided to enter into an agreement with the Gas Light and Coke Company for the supply of gas for lighting, cooking, and heating purposes to houses on the Ilford (No. 1) Section of the Becontree Estate; the Company laying the mains and service-pipes, carcassing the houses, and supplying and fixing certain fittings, in consideration of a capital payment of £22 a house. This sum has since been reduced to £17 17s. 10d. Reporting to the Council this week, the Housing Committee stated that the Company, after negotiation, offer, in return for a payment of £5 17s. 6d. for each dwelling, to carry out the installations now required in the houses and flats, about 1000 in number, in course of erection on the Dagenham (No. 2) Section of the estate. Having been advised that the price asked by the Company is reasonable, they recommended the Council to agree to these terms, which the Company are willing to apply, at the Council's option, to any further houses commenced on the estate before Midsummer, 1925. The Finance Committee concurred in the proposal, which had been approved by the Minister of Health.

# PARLIAMENTARY INTELLIGENCE.

## HOUSE OF LORDS.

### Progress of Bills.

Rawmarsh Urban District Council Bill: Read a second time, and committed.

Macclesfield Corporation Bill: Read the third time, and passed; sent to the Commons.

Swanage Gas and Electricity Bill: Read the third time, an passed; sent to the Commons.

Barnsley Corporation and Birkenhead Corporation Bills: Brought from the Commons, read the first time, and referred to the Examiners.

## HOUSE OF COMMONS.

### Progress of Bills.

Barnsley Corporation and Birkenhead Corporation Bills: As amended, considered; read the third time, and passed.

Plymouth Corporation Bill: Read a second time, and committed.

South Staffordshire Mond Gas Bill: Standing Orders not previously inquired into complied with; to be read a second time.

Lytham St. Anne's Corporation Bill: Read a second time, and committed.

Macclesfield Corporation and Swanage Gas and Electricity Bills Read the first time, and referred to the Examiners.

Hoylake and West Kirby Gas and Water Bill: Lords amendments considered, and agreed to.

### Gas Regulation Act.

Copies were presented of Statements of Objection deposited with the Board of Trade by the Barnsley Corporation and the London, Midland, and Scottish Railway Company to the Special Order proposed to be made by the Board under the Act on the application of the Barnsley Gas Company. These were referred to the Select Committee to be appointed to consider the Order.

### Gas (Carbon Monoxide).

Mr. HARDIE asked the President of the Board of Trade whether he could give the carbon monoxide content in gas necessary to give heat required for domestic heating and cooking.

Sir P. LLOYD-GREAME said that the question did not seem to be one to which a precise answer could be given. The problem was one of practicability and cost rather than of physical necessity.

Mr. HARDIE: In relation to the questions which were put last week as to the claim now made for a non-carbon-monoxide gas, will the right hon. gentleman give from the analysis of the gas supplied to consumers the carbon monoxide content, and give the heat content of the gas *minus* this carbon monoxide content?

Sir P. LLOYD GREAME: No doubt that is very relevant, but it is not the question put down on the paper.

### Gas (Thermal Value).

Mr. HARDIE asked the President of the Board of Trade whether the Committee investigating the British thermal value in gas supply have yet reported upon the thermal value of different coals used in the manufacture of gas?

Sir P. LLOYD GREAME thought that Mr. Hardie was under a misapprehension. The Board of Trade Committee which he presumably had in mind was appointed "to inquire and report as to the method of charging for gas on a thermal basis;" and their report did not deal with the larger problem to which Mr. Hardie referred. It was essentially one for the Fuel Research Board established by the Department of Scientific and Industrial Research, and was one of the matters under their consideration.

## TORQUAY CORPORATION BILL.

This Bill [see "JOURNAL," Feb. 14, p. 386] has been under consideration by the Local Legislation Committee of the House of Commons (presided over by Sir Thomas Robinson) for some days; and on Tuesday of last week the clauses of the gas section were dealt with. There was no opposition.

The Bill contains the usual clause as to the construction and placing of pipes, &c., between mains and meters; but an addition has been made, relating to the Great Western Railway Company. Sub section 4 of the clause provides that every meter to be used in a new building, or a building not previously supplied with gas, shall be placed as near as reasonably practicable to the Corporation's mains, but within the outside wall of the building. The addition to the clause provides that in the case of a building of the Great Western Railway Company used for railway purposes, and in connection with which there is provided outside the building accommodation reasonably approved by the Corporation for the meter, or a separate meter house, the meter may be placed here instead of within the outside wall of the building.

There was some discussion with regard to the standby clause in the Bill. This clause provides that a person shall not be entitled to demand or continue to receive from the Corporation, for the purposes of a standby only, a supply of gas for any premises for which he has, at the same time, a supply of gas or electricity, unless he has agreed to pay to the Corporation a minimum annual sum which will give them a reasonable return on the capital expenditure.

Mr. H. C. HONEY (Director of Gas Administration, Board of Trade) said he was not quite sure whether the Corporation wanted to be able to make this charge except where the supply of gas was from a source other than that of the Corporation, or the supply of electricity was from some other installation.

Mr. W. J. JEEVES, K.C. (for the Corporation), stated that the reason why these powers were asked for was that in the greater part of the borough the supply of gas was by a company, so that a consumer might have a general supply from the company and still be demanding a standby supply from the Corporation. The Corporation were only the gas undertakers in the part of the borough which had been added by an extension Order. If a supply were required only for use in the case of a breakdown, the person concerned should not be entitled to demand it unless prepared to meet the expense to which the Corporation were put.

In reply to Mr. CAPE (a member of the Committee), Counsel said there was no petition, and it would probably be found that whenever the Gas Company came to Parliament they would ask for similar protection. These standby supplies were not favoured by undertakers, because they had the effect of increasing the cost to their customers.

Mr. WILLIAM RUSSELL (a member of the Committee) referred to the case of a person obtaining a supply of electricity, and also a supply of gas which he did not need, and said that in this case the clause would operate.

Mr. JEEVES replied that, supposing a consumer were in a position to demand suddenly from the gas undertaking (say) 10,000 or 20,000 c.ft. of gas, it would mean that they would have to keep up their retorts and have everything ready, in order that the consumer should not suffer by way of a breakdown in the supply of electricity. Was it reasonable that all the other consumers of gas should have to bear additional expense for the benefit of that particular consumer?

Mr. HONEY said the view of the Board of Trade would be that the clause should be confined to cases where gas was supplied by someone other than the Corporation, and in the same way, in the case of electricity, where electricity was supplied by someone other than the Corporation. To the principle of the clause they saw no objection; it had been recognized by Parliament over and over again.

Mr. JEEVES said Parliament had gone further than that in the Electricity Act, under which a person was not entitled to demand, for purposes of a standby only, from authorized undertakers electricity for premises having a separate supply of electricity or a supply of gas, steam, or other form of energy, and it seemed to him that the case he had put forward ought really to apply. If a man chose to have a supply of electricity on the best terms he could get, and then said, by way of compromise, that he was going to have a supply of gas, and that (though probably he would not want it) the gas undertakers must keep it ready for him, then that did place a burden on other consumers.

The CHAIRMAN asked what was the position if he had two or three lights and a gas-cooker, and he decided that he would substitute electricity for gas for lighting purposes, but would use gas for the cooker?

Mr. JEEVES replied that in that case he would not be using gas for the purpose merely of a standby.

The CHAIRMAN said the position was that if gas were used at all for any purpose, then the clause would not apply.

Mr. JEEVES agreed, and added that it ought not to apply, because the undertaking would be denying to a consumer that which he was authorized to have. In his own house gas was used for heating and cooking, but not for lighting. He would not be justified in asking for this clause if it covered the point the Chairman had raised.

Mr. W. BROWN (a member of the Committee) said he understood that the burden in the case of gas would not be so great as in the case of electricity, because they could store gas.

Mr JEEVES agreed, but said they had to find storage for the gas, so that the capital expenditure would have to be taken into consideration.

The Committee allowed the clause.

The Bill contains the usual clause with regard to the laying of pipes in private streets; but there has been added a provision that the Corporation shall not break-up a street belonging to the Great Western Railway Company except upon agreed terms, or, failing agreement, upon terms settled by an engineer appointed by the President of the Institution of Civil Engineers.

The clause relating to the application of gas revenues has been amended. Originally, the first part of this provided that the Corporation could carry the net surplus revenue and the annual proceeds of the reserve fund, when amounting to the prescribed limit, to the credit of the borough rate, or, at their option, could apply the surplus, or some part of it, in the reduction of the capital moneys borrowed for gas purposes, or to any other purposes of the undertaking. Any deficiency of income in any year was to be payable out of the borough rate. This part of the clause has now been struck out, and other provisions substituted. It is now provided that all moneys received in respect of the gas undertaking (including interest on reserve fund when the fund amounts to the prescribed maximum) shall be carried to, and form part of, the borough fund, and all payments and expenses made and incurred in respect of the undertaking shall be paid out of that fund. Whenever the moneys so received shall exceed to the extent of £1000 or more the amounts paid in respect of the payments and expenses, then the charges for gas in the next succeeding year shall be reduced to an extent equivalent to not less than the amount of such excess over £1000.

## CHESTERFIELD CORPORATION BILL.

This Bill [see "JOURNAL," Feb. 14, p. 385] has been considered by the Local Legislation Committee of the House of Commons, presided over by Sir Thomas Robinson. On Thursday last the gas section was dealt with.

The clause which provided that the price to be charged for gas should not exceed 5s. per 1000 c.ft. within the borough and 5s. 6d. outside (unless and until the Board of Trade, pursuant to the provisions of the Gas Regulation Act, otherwise ordered) has been struck out of the Bill, in view of the fact that a Therm Order is about to be granted to the Corporation.

Mr. W. E. TYLDESLEY JONES, K.C. (for the Corporation), said that the borough was extended in 1920, when the powers and duties of the Chesterfield Gas and Water Board were taken over by the Corporation. They had power to charge up to 1s. per therm for gas inside the borough, and 1s. 1½d. outside. This was equivalent to 5s. 4d. per 1000 c.ft. inside the borough; but they were not charging anything like this amount. They were not yet on the therm basis, but were charging 3s. 6d. per 1000 c.ft. for lighting purposes inside the borough.

Mr. H. DAVIES (Gas Engineer and Manager to the Corporation) said that since the Corporation had had the gas undertaking they had been continually lowering the price of gas. It had been reduced to such an extent that the last profit was only between £100 and £200.

# MISCELLANEOUS NEWS.

## GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" with regard to applications to the Board of Trade for Orders under the Gas Regulation Act.

### Abergele Gas, Coke, and Water Company, Ltd.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. 5d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 9d. per therm.

### Caldicot and District Gas Light and Coke Company, Ltd.

The maximum price authorized by the Caldicot and District Gas Order, 1908, in respect of the supply of gas by the undertakers was 5s. 6d. per 1000 c.ft.; but by the Caldicot and District Gas (Charges) Order, 1921, this was increased to 8s. The price they have asked the Board of Trade to substitute for this is 1s. 7d. per therm.

### Cowes Urban District Council.

The maximum price now authorized in respect of the supply of gas by the undertakers is 4s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 8d. per therm.

### Godstone District Gas Company, Ltd.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 10d. per therm.

### Lampeter, Llandyssul, Tregaron, and Aberayron Gas Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 6s. 3d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 4½d. per therm.

### Leeds Corporation.

The maximum price now authorized in respect of the supply of gas by the undertakers is 3s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 2d. per therm.

It is also proposed that an additional charge of 2d. per therm should be authorized in respect of gas supplied through a prepayment meter.

### Little Hulton Urban District Council.

The maximum prices now authorized in respect of the supply of gas by the undertakers is 3s. 6d. per 1000 c.ft.; and the price which they have asked the Board of Trade to substitute for this is 1s 4d. per therm.

It is also proposed that additional charges per therm should be authorized in respect of gas supplied through a prepayment meter as follows: 3·6d. per therm if a cooking-stove is included; 3d. per therm if a cooking-stove is not included; and in the case of a prepayment meter without fittings, 1·8d. per therm, or at the rate of 10 p.ct. per annum on the cost of the meter, whichever shall be the higher.

### Morley Corporation.

The maximum price now authorized in respect of the supply of gas by the undertakers is 4s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 3d. per therm.

It is also proposed that an additional charge of 1½d. per therm should be authorized in respect of gas supplied through a prepayment meter.

### Rothwell (Northampton) Urban District Council.

The maximum price now authorized in respect of the supply of gas by the undertakers is 4s. 6d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 4d. per therm.

### St. Margaret's Gas Company, Ltd.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 8d. per therm.

It is also proposed that an additional charge of 2·5d. per therm should be authorized in respect of gas supplied through a prepayment meter.

### Tamworth Gas Light and Coke Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 8d. per therm.

The maximum differential price now authorized in respect of the supply of gas by the undertakers outside the Borough of Tamworth is 8d. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1·78d. per therm.

It is also proposed that an additional charge of 2·5d. per therm should be authorized in respect of gas supplied through a prepayment meter.

### Thirsk Gas Company.

The maximum price now authorized in respect of the supply of gas by the undertakers is 5s. per 1000 c.ft.; and the price they have asked the Board of Trade to substitute for this is 1s. 7d. per therm.

It is also proposed that an additional charge amounting to about ½d. to ¾d. per therm should be authorized in respect of gas supplied through a prepayment meter, making the authorized charges respectively: 2d. for meter only, 2½d. for meter and fittings, and 3d. for meter, fittings, and cooker.

### DECLARATIONS OF CALORIFIC POWER.

**Brentford Gas Company.**—500 B.Th.U., in substitution for 460 B.Th.U. (Sept. 26.)

**British Gas Light Company, Ltd. (Hull Station).**—460 B.Th.U. (June 22.)

**South Suburban Gas Company.**—480 B.Th.U., in substitution for 460 B.Th.U. (Sept. 13.)

**Tipton Urban District Council.**—450 B.Th.U. (Sept. 10.)

**Todmorden Town Council.**—430 B.Th.U. (June 30.)

## GAS REGULATION ACT ORDERS.

We have received from the Director of Gas Administration copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

### Colwall Gas Company, Ltd.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 18d. per therm; and this price shall be substituted for the price of 5s. 8d. per 1000 c.ft. wherever it is mentioned in section 25 (price of gas) of the Colwall Gas Order, 1898.

After the declared date, the word "therm" shall be substituted for "1000 c.ft." in paragraph (ii.) of Schedule B to the Colwall Gas Order, 1898; and the words "fifth of a penny" shall be substituted for the word "penny" wherever it occurs in that paragraph. (June 11.)

### Formby Gas Company, Ltd.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 15d. per therm. (June 11.)

### Hayfield Gas Company, Ltd.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 14·6d. per therm; and this price shall be substituted for the maximum price per 1000 c.ft. mentioned in section 26 (price of gas) of the Hayfield Gas Order, 1909, as amended by section 16 (price of gas amendment of section 26 of the Order of 1909) of the Hayfield Gas Order, 1914.

After the declared date, the word "therm" shall be substituted for "1000 c.ft." in paragraph 2 of Schedule B to the Hayfield Gas Order, 1909, and the words "fifth of a penny" shall be substituted for the word "penny" wherever it occurs in that paragraph. (June 12.)

### Nantwich Urban District Council.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 18d. per therm. (June 15.)

### Quorndon and Mount Sorrel Gas, Coke, and Coal Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 16d. per therm.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by five. (June 14.)

### Swinton and Mexborough Gas Board.

After the declared date, the maximum price in respect of gas supplied by the undertakers shall be 16d. per therm.

Prepayment meter clauses are included. (June 14.)

### Tawe Valley Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 16·6d. per therm.

For the purpose of ascertaining the authorized rate of such dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by four.

Prepayment meter clauses are included. (June 12.)

## Mossley Corporation Gas Department.

The fourth annual report of Mr. W. Bennett, Engineer and Manager of the Mossley Gas-Works shows that the net profit is the highest recorded for the Department—and this in spite of reduced prices of gas. The total receipts on revenue account amount to £48,551; the expenditure being £36,066. This leaves a gross profit of £12,484, which, after deduction of interests on loans, income-tax, and instalment to sinking fund, leaves a net profit of £3957. During the past year, it is stated, a saving of £631 has been effected on the repair of meters, which work is now carried out by the Department. Compared with last year, the gas rental is down by £4989, due to the decreased cost of gas. Though the gas sent out shows a slight reduction on the figure for the previous year, the gas accounted for reveals an increase of 12,121,300 c.ft., or 7·3 p.ct The unaccounted-for gas amounts to 3·2 p.ct. of the total make. This, it is believed, is among the lowest in the country; the leakage amounting to 114.376 c.ft. per mile of main. The return of the sales of gas appliances furnishes a remarkable and entirely satisfactory increase; the number of cookers sold during the year being 599. During the year a tar dehydrating plant has been installed, and a scrubber of a capacity of 1 million c.ft. per day has been erected.

The Directors of the European Gas Company, Ltd., have decided to recommend the payment, on Aug. 1 next, of a final dividend of 5s. per share, free of income-tax, which, with the interim dividend paid on Feb. 1 last, will represent a total dividend of 5 p.ct., free of income-tax, for the year ended March 31 last.

## NOTTINGHAM GAS UNDERTAKING.

### A Record Profit of £181,367.

Substantial financial results accruing from the operations of the Nottingham municipal gas undertaking have formed the subject of consistently recurring references in annual reports presented by the responsible Committee to the Corporation; but never before have figures representing a more striking achievement been brought under notice than those which were embodied in the statement submitted at the last meeting of the Council dealing with the accounts completed up to March 31. This year's profit of £181,367 easily surpasses all previous results. Certain critics have suggested that this has only been rendered possible of attainment by the maintenance of inordinately high charges, and that, particularly in the interest of smaller consumers, some relief may be reasonably looked for by a reduction of the present rates. A substantial lowering of the scales was brought into operation during the past year, in which the Committee were favourably placed with regard to contracts for coal. In keeping with the policy of sound finance which has hitherto characterized the conduct of the undertaking under the chairmanship of Alderman Albert Ball, while substantial additions have continued to be made to the reserve funds, attention has recently been directed to the acceleration of the reduction of the capital debt of the undertaking, £20,000 having been placed to the annuities sinking fund, and £20,000 to the loan and debenture stock sinking fund, in addition to the usual annual contribution. The debt upon the undertaking, compensated for by adequate assets in the way of plant, &c., still remains considerable; the capital account showing a total of £975,378, made up of annuities of £281,400, loans of £211,667, debenture stock of £47,810, and consolidated stock of £434,501. The reserve fund represented a total of £233,478 up to the end of March last. The number of annuities, of the nominal value of £50 each, originally issued was 7242, of which 1614 have been repurchased at a cost of £88,034. It may thus be deduced that the undertaking is at all points in a sound financial position, resulting from careful administration.

It was explained in the report that the income for the year upon the revenue account had amounted to £678,149 and the expenditure to £496,781, leaving a balance of £181,367 to be carried to the profit and loss account; and to this had been added £1823, representing bank interest on revenue account investment, together with £39,873 brought forward from last year. After charging interest on capital, contributions to the sinking funds, £5000 for depreciation of mains, £5000 for depreciation of stoves, and £5000 for depreciation of meters, there remained an available balance of £89,034. The Committee, having decided to allocate £30,000 as a contribution in aid of the general district rate, recommended that £10,000 should be transferred to the renewals account, and that the balance of £49,034 be carried forward. In addition to taking into consideration the acceleration of the reduction of the capital debt of the undertaking, it had been also considered advisable to make some provision to meet the increased income-tax which will become payable during the financial year ending March 31, 1924, and, as the Committee considered that the profits for that period will most probably be less than normal, a reserve of £18,500 had been set aside to meet this contingency. The following reductions in the charges for gas came into operation during the year; and the full effect of these reductions would be reflected in the receipts for gas included in the next accounts. From July 1, 1922, 6d. per 1000 c.ft. for ordinary meters, and 1d. in the shilling rebate on prepayment meters; from Jan. 1, 1923, 6d. per 1000 c.ft. for ordinary meters, and 1d. in the shilling rebate on prepayment meters.

The receipts for coke showed a decrease of £37,972 as compared with the previous year, and the receipts for tar products also showed a substantial reduction—viz., £7897. The receipts for ammonia products and sulphuric acid showed an increase of £3384. The quantity of gas sold during the year was 2,417,399,300 c.ft., as against 2,375,075,700 c.ft. the previous year, being an increase of 42,323,600 c.ft.

#### MR. JOHN WILKINSON'S REPORT.

Much interesting information is embodied in the twelfth annual report of Mr. John Wilkinson, Engineer and General Manager of the undertaking, which is appended to that of the Committee, he recording that during the period under review, 185,263 tons of coal and 24,944 gallons of oil were utilized in the manufacture of the following products: Coal gas, 2,511,748,000 c.ft.; water gas, 11,095,000 c.ft.—a total of 2,522,843,000 c.ft.; the water gas equalling 0·44 p.ct. of the total gas made; coke (for sale), 89,968 tons; tar, 11,080 tons; ammoniacal liquor (10-oz. strength), 28,312 tons. The following are the details of the sale of gas during the year: Ordinary consumers, 1,268,029,100 c.ft.; prepayment consumers, 773,604,300 c.ft.; power consumers, 241,400,700 c.ft.; gassing consumers, 17,563,900 c.ft.; public lamps, 116,801,300 c.ft.; total, 2,417,399,300 c.ft. These figures indicate an increase of 1·78 p.ct. when compared with the sale of gas for the previous year. The gas unaccounted for during the year was 4·18 p.ct., as compared with 2·89 p.ct. The sale of gas per ton of coal carbonized was 12,991 c.ft., as compared with 12,917 c.ft. for the previous year.

Alderman A. BALL moved the adoption of the report. The profits made last year were largely due to the good purchases of coal which they were then able to effect; the cost having been £130,000 less than in the previous year. Unfortunately coal owners had put up the price again; and the Committee were now paying 3s. per ton more than last year. In the period under review, they had been paying 21s. 9d. per ton as compared with 36s. 5d. for the previous year; and this accounted for the abnormal profit which they were able to report. He ought also to say that the profitable results had been largely due to excellent management. He did not mean to imply thereby the management in so far as the Committee were responsible, but the splendid control which had been exercised by Mr. John Wilkinson and other officials of the Corporation associated with him. He (Ald. Ball) had no doubt, however, that the report of the Committee would be criticized as it always had been; past experience having shown that the greater the profit which they made the more was the criticism they received.

Alderman H. BOWLES, an ex-Mayor of the city and leader of the Labour Party in the Council, observed that they had the doubtful privilege of not knowing whether charges would not be increased under the therm system, because while they might have been able to calculate what the cost would be under the old plan of charging by so much per 1000 c.ft., it was doubtful if they would arrive at the correct amount under the therm system. He congratulated the management upon the results which had been attained in connection with the working of the undertaking. He observed that the report included reference to the fact that the number of complaints received during the last annual period was fewer than at any time within the last ten years, and the circumstance appeared to indicate that the quality of the gas supplied had been materially improved.

Mr. A. JUDD directed attention to the fact that the sum of £18,500 had been mentioned as having had to be paid in income-tax, and suggested that as this represented ninepence in every pound taken for revenue purposes, it was undesirable that so large a profit, entailing the necessity of paying such a big sum in income-tax, should be amassed. He contended that their object as municipal representatives should be to provide the public with necessary services at a price as near to cost as possible, and not indirectly to tax consumers, and particularly those of the poorer class, in order to show big profits.

## THE NATIONAL GAS EXHIBITION.

### Forthcoming Display at Bingley Hall, Birmingham.

Further particulars are now to hand regarding the National Gas Exhibition, demonstrating the service of gas in the home and in industry, which is to be held in Bingley Hall, Birmingham, from Sept. 17 to Oct. 3 next—the last three days of the exhibition coinciding with the annual conference of the British Commercial Gas Association, which is to take place in Birmingham. Bingley Hall is in every way an excellent place for such a show.

The Right Hon. the Lord Mayor of Birmingham (Alderman David Davis, J.P.) has consented to act as President of the exhibition; and the Presidents of all the national bodies connected with the industry, and many others, have already agreed to act as Vice-Presidents. Invitations in this connection are also being extended to the chairmen of gas undertakings, and to other members of committees or boards of directors. The exhibition is under the control of an Executive Committee, representing the Midland Commercial Gas Association. Alderman J. H. Lloyd, M.A., J.P., the President of the British Commercial Gas Association, who is also Chairman of the Birmingham Corporation Gas Committee, has accepted the Chairmanship of the Executive Committee; Mr. A. W. Smith, General Manager and Secretary of the Birmingham Gas Department, has been appointed Deputy Chairman; Mr. R. J. Rogers, the Fittings Superintendent of the Birmingham Gas Department, is acting as Hon. Secretary of the Committee. The Executive have been fortunate in securing the services as Exhibition Director of Mr. Charles Stanley, who has been connected the whole of his life with the promotion of exhibitions, and who is the well-known General Manager of the British Industries Fair (Birmingham Section). Sub-Committees have been formed to deal with Competitions, Finance, Publicity, Smoke Abatement, and Technical Subjects.

Apart from the exhibits which will be contributed by the most important firms connected with the gas industry, special features will be made of displays of the uses of gas for lighting, heating, cooking, power, and industrial purposes. It is intended to have working demonstrations of gas fired furnaces, gas-engines, and other appliances. Particular attention will be given to the bye-products side of the industry, and the part that gas can play in the direction of smoke abatement; while attention will also be given to the publicity and advertising side of the industry. On behalf of the Midland gas undertakings, it is proposed to arrange a comprehensive co-operative display of model rooms fitted with gas appliances. In order to bring home to the public the care and attention which is devoted to the manufacture of gas appliances, working demonstrations are being arranged. Among these will be the manufacture and testing of gas-meters and the manufacture of gas-mantles. Cookery demonstrations, lectures, and competitions will be held.

The Executive Committee are making extensive preparations for ensuring the maximum of national, district, and local publicity in connection with the exhibition; and in this connection the "B.C.G.A." are lending assistance. It is also proposed to organize a series of popular and scientific lectures dealing with subjects closely allied with the gas industry, and having a direct bearing on the use of gas in various ways. A special feature will be made of the historical section of the exhibition; and in this connection the loan has been promised of the Murdoch relics from the Birmingham Public Library, and other objects of historical interest from different sources.

The address of Mr. Charles Stanley, the Exhibition Director, is No. 27, Paradise Street, Birmingham.

**The Wanganui Gas Department.**—The gas-works account shows a very satisfactory result. After transferring £8000 to the general account, there remains a surplus of £3097. The revenue from the sale of gas exceeds that of last year by £1116—notwithstanding a reduction of 1s. per 1000 c.ft. which came into operation on Dec. 1, 1922. The cost of coal and wages shows a reduction of £9090 and £2204 respectively, and that for repairs and maintenance an additional expenditure of £1314. The amount expended on new plant was £4003, which, added to the sum spent during the previous years makes a total of £42,625. During the past twenty years the department have contributed £52,381 towards the relief of rates. The sum of £30,910 accumulated sinking fund has been applied for the reduction of the loan debt on the undertaking; and there is at the present time a further fund of £10,840 towards the repayment of the existing debt of £116,466.

## THE NORTH-EAST COAST COAL TRADE.

### From Our Own Correspondent.

The firmer tone which developed in the market for Durham coals at the end of last week has been maintained during the present one. From the colliery point of view, the gas position is firm and satisfactory. Adverse reports as to the Newcastle market chiefly concern Northumberland steams. In these there has been a further drop in prices during the week; but the gas and coking positions have been too strong to be affected. Colliery towns are very full; and any weakness which may be apparent is on the part of holders of coal who have not placed their month's quantities, and are anxious to do so rather than have them cancelled.

While exporters maintain that congestion in Continental ports will limit shipments for some time to come, and while they talk of a 25s. market in the near future, their view is not shared by colliery fitters. It is difficult to obtain best gas at anything under 30s.; and this price is actually being paid for odd spot lots. At the same time, the position for forward is still firm at 30s.; and collieries are inclined to hold out for this figure for best qualities, with seconds perhaps 1s. to 1s. 6d. less. General inquiry has been good during the week, and the chance of further business for Australia has been a strengthening influence.

Coking coals have kept steady, and during the week a good deal of new business is said to have been fixed up for the second half of the year at 30s., and some seconds down to 29s. This, of course, tends to keep the gas-coal market steady at these figures.

## COAL TRADE IN THE MIDLANDS.

### From Our Local Correspondent.

A large number of important contracts have now been fixed-up for the ensuing year, and negotiations are nearing completion in most of the outstanding cases. Reticence is observed as to precise details; but it may be taken that advances of varying amounts apply to the new arrangements. Terms have been come to very generally in a spirit of reasonableness. Though many of the undertakings have had to pay more than they bargained for a few months ago, some of the recent quotations by collieries would convey an exaggerated view of actual business. The conditions are hardly so favourable for sellers as they were a month ago. Though there are still large deliveries to be made abroad, new sales have not been on so big a scale. There are now hints of less activity at home so far as the industrial demand is concerned. This is offset in only a small degree by the continued inquiry for house coal under the stimulus of the unseasonable weather.

Gas-coke prices have not relapsed further; and furnace coke, apart from some district dislocations, maintains its position. In view of the abstention from buying of pig-iron consumers, some furnace owners are curtailing production; and this may give a new aspect to the coke market. South Wales collieries are insisting upon full prices for export, notwithstanding the declining shipments.

## YORKSHIRE AND LANCASHIRE COAL TRADE.

### From a Local Correspondent.

The lull in the demand for export coal of the larger descriptions still continues in Yorkshire and Lancashire; and smalls have maintained recent prices. There does not appear to be any immediate prospect of a change in the position.

Gas coal for inland consumption is reported to have been sold by producers at advances of 1s. to 1s. 3d. per ton. Many gas concerns, however, refuse to pay more than 6d. per ton advance on last year's figures.

There is still no improvement in the industrial consuming section; and while many collieries are seeking advanced figures for their production of steam coal, to the extent of 1s. 6d. to 3s. per ton, in view of the anticipated rise in miners' wages—there is a possibility that the present state of trade will not enable the manufacturers and others to meet the increase.

The f.o.b. prices at Hull last week were: Best South Yorkshire hards, 26s. 6d.; West Yorkshire Hartleys, 26s. 6d. to 27s.; South Yorkshire washed doubles and singles, 28s. 6d.; dry doubles, 25s. 6d.; washed smalls, 24s. 6d. to 25s.; Yorkshire rough slack, 20s. to 21s.; gas coke, 32s. 9d.; furnace coke, 40s. per ton.

Lancashire prices at the pits: Best house coal, 33s.; industrial coal, 20s. to 22s.; slacks, 13s. to 15s.; washed slacks, 17s. per ton.

## TRADE NOTES.

Messrs. Ruston and Hornsby, Ltd., of Lincoln, furnish us with particulars of their Hornsby-Stockport gas-engine and suction gas producer which they intend to exhibit at the forthcoming Royal Show at Newcastle. The makers state that in the design of the engine, real simplicity has been aimed at. All parts are visible and removable without taking the engine to pieces. Adjustments may easily be carried out; and constant attention or regulation is not required. Wearing surfaces are exceptionally large, giving great durability; and the design of the interior of the combustion chamber, combined with the absence of friction, gives low fuel consumption. Every wearing part and every joint can be lubricated without trouble. Sizes up to 70 B.H.P. are fitted with sensitive "hit and miss" governors. Those over 70 B.H.P. are fitted with the "variable admission" type. The cylinder liner is water cooled. The outstanding points of the suction producers are simplicity of the design, ease in handling, certainty in action, regularity in the quality of the gas produced, and economy in fuel.

The Manchester Gas Committee have decided to let out on simple-hire terms geysers and gas-heated circulators.

## CURRENT SALES OF GAS PRODUCTS.

### The London Market for Tar, Tar Products, and Sulphate.

LONDON, *June* 18.

In the London market creosote is rather scarce, and the value is about 10¾d. to 10¼d. net per gallon in bulk *ex* makers' works. Pitch is quite inactive, and is likely to remain so until Continental users come in to buy. Meantime, the price is nominal. Benzole, toluole, and solvent naphtha are unchanged. There is more inquiry for crude carbolic acid, and the price is moving upward.

### Tar Products in the Provinces.

*June* 18.

The average values for gas-works products during last week were: Gas-works coal tar, 70s. 6d. to 75s. 6d. Pitch, East Coast, 117s. 6d. to 122s. 6d. f.o.b. West Coast—Manchester, 115s. to 120s.; Liverpool, 116s. to 121s.; Clyde, 118s. 6d. to 123s. 6d. Benzole 90 p.ct., North, 1s. 6d. to 1s. 6¼d.; crude 65 p.ct. at 120° C., 1s. to 1s. 0¼d. naked at makers' works; 50-90 p.ct., naked, North, 1s. 8d. to 1s. 8¼d. Toluole, naked, North, 1s. 11d. to 2s. nominal. Coal tar crude naphtha in bulk, North, 8¼d. to 9d. Solvent naphtha, naked, North, 1s. 4¼d. to 1s. 6d. Heavy naphtha, North, 1s. 6d. to 1s. 8d. Creosote, in bulk, North, liquid, 7¾d. to 8¼d.; salty, 7¼d. to 7¾d; Scotland, 6¾d. to 7¼d. Heavy oils, in bulk, North, 9d. to 9¼d. Carbolic acid, 60 p.ct., 3s. 5d. to 3s. 6d. prompt. Naphthalene, £15 to £16; salts, £6 to £8, bags included. Anthracene, "A" quality, 4d. per minimum 40 p.ct., purely nominal; "B" unsaleable.

### Salary Question at Middlesbrough.

The question of the reduction of the salaries of the chief officials of the Middlesbrough Corporation is proving a very long drawn-out affair. To the Town Council, on Tuesday of last week, the General Purposes Committee brought forward the recommendations of a Special Sub-Committee. These asked the Corporation to order that no change should be made in the salary of the Gas Manager (Mr. C. F. Blincoe), but that the allowance of the late Manager, Mr. David Terrace (now Consulting Engineer), should be reduced from £250 to £100. The whole of the recommendations were referred back, however, several members expressing regret that the Sub-Committee had achieved nothing better; and when the General Purposes Committee met last Friday, the question was again gone into. It was moved that the recommendations should be re-affirmed; but the opposition succeeded in getting the Committee to adopt the system of a percentage reduction. They failed, however, to carry a clean, graduated cut for all cases, and each individual one was gone into separately. When that of the Gas Manager was being considered, the Chairman (Alderman T. G. Poole) advised the meeting that Mr. Blincoe was not being too well paid. If the Corporation wished to fill his place, they would probably have to pay several hundred pounds a year more. The meeting, nevertheless, decided that there should be a reduction of 5 p.ct. on the salary of £740. The Consulting Engineer was also called upon to suffer a reduction of 40 p.ct., which means that, if the decision is approved by the Council, his allowance will be £150.

**Accrington Gas Profit.**—At a meeting of the Accrington Gas Board last Friday, the Chairman announced a net profit on the year's working of £18,417, compared with a loss for the previous year of £5000. In addition, there had been substantial reductions in charges, which to-day stood at 45 p.ct. above pre-war rates. This compared favourably with the charges of similarly-placed undertakings. Another pleasing feature was the fact that though they had manufactured 5 million c.ft. of gas less than last year, they had sold 6½ million c.ft. more, due to a saving of 11½ million c.ft. on the unaccounted-for gas. They hoped this would be permanent. It was the lowest leakage they had had for nine years. They looked forward to still more satisfactory returns when the scheme of reconstruction was completed.

**Tiverton Gas-Works Balance-Sheet.**—The balance-sheet for the year ended March 31 last, presented at a meeting of the Tiverton Town Council, shows a balance of £2734 disposed of in interest and loan repayment, and £1219 carried to the reserve fund, which now stands at £4510. Out of this it is intended to pay £500 towards the general district rates. During the year the price of gas was twice reduced. Sales amounted to £19,504. In all, £43,305 had been raised by loans for capital expenditure; and the total indebtedness was now £10,103. The Council received sympathetically a suggestion by Councillor Searle that a superannuation (contributing) scheme should be evolved for the gas workers. Mr. Gregory announced that the electricity scheme would probably be delayed till next February or March.

The Leeds Gas Committee propose the purchase, for the sum of £7000, of an approximate area of 4120 square yards of land in Regent Street and Gower Street, required in connection with the provision of workshops in substitution of the existing ones in Sovereign Street.

Damage variously estimated at from £8000 to £10,000 resulted to premises of the Scottish Co-operative Wholesale Society, in Sussex Street, Glasgow, from a fire which is supposed to have been caused by the fusing of an electric wire. The flames spread with great rapidity; and in the rush for safety four girls and a man suffered from burns and cuts.

As the result of a fire which broke out last Wednesday afternoon at the Highbury War Pensions Hospital, Birmingham, two patients lost their lives and five other men sustained injuries. The conflagration was in an army hut, which was erected near the main building, and was used as an open-air ward. It was about half-past two that the fire broke out; and constructed as the building was of wood with a corrugated iron roof, the flames spread with extraordinary rapidity. The origin of the fire is attributed to a gas geyser used for heating the bath in the lavatory of the ward. Although it was not known definitely, it was conjectured that the flames from this may have set fire to a towel.


***Abridged Prospectus.***

**A Copy of the Prospectus has been filed with the Registrar of Joint Stock Companies.**

**Applications should be lodged by the 30th June, 1923.**

# The Colonial Gas Association, LIMITED.

*(Incorporated under the Companies Acts, 1862 to 1886.)*

**ISSUE AT PAR OF:—**

**33,720 7% Preference Shares of £1 each.**
**40,000 Ordinary Shares of £1 each.**

Payable as follows:—

| | | |
|---|---|---|
| **2s. 6d.** | **per share ...** | **on Application.** |
| **7s. 6d.** | **„ „ ...** | **on Allotment.** |
| **5s. 0d.** | **„ „ ...** | **on 1st September, 1923.** |
| **5s. 0d.** | **„ „ ...** | **on 1st November, 1923.** |

**Directors.**

SAMUEL SPENCER, Assoc.Inst.C.E. (Chairman).
CHARLES HUNT, M Inst.C.E.
FREDERICK RICHARD SMITH, Assoc.Inst.C.E.
HENRY KING HILLER, M.Inst.M.E.

**Directors in Australia.**

P. C. HOLMES HUNT, M.Inst.C.E. (Chairman and Managing Director).
HON. SIR JOHN W. TAVERNER, K.C.M.G.
JOHN SIMPSON WEIR.

**Bankers.**

WESTMINSTER BANK, LTD., 4, Bartholomew Lane, London, E.C. 2.
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ROYAL BANK OF AUSTRALIA, LTD., Melbourne.

**Solicitor.**

C. HOLMES HUNT, M.A., 17, Victoria Street, Westminster, S.W. 1.

**Auditors.**

WOOD, DREW & CO., 139, Cannon Street, London, E.C.

**Secretary and Registered Offices.**

ALFRED J. KINGDON, Suffolk House, Laurence Pountney Hill, London, E.C. 4.

*Australian Office:* 360, Collins Street, Melbourne.

The new Capital now being raised will be used for the repayment of an overdraft obtained from the Company's Bankers in Australia for extensions to Works, Mains, etc., rendered necessary by the increasing demand for Gas, consequent upon the continued growth and development of the townships served by the Company, also for other extensions in contemplation which will shortly be commenced.

**The following figures show the progressive nature of the Company's business:—**

| Year. | Gas sold cubic feet. | No. of Consumers. |
|---|---|---|
| 1918 ... ... | 253,546,000 ... | 12,838 |
| 1919 ... ... | 279,404,000 ... | 12,963 |
| 1920 ... ... | 281,767,000 ... | 13,890 |
| 1921 ... ... | 287,975,000 ... | 14,163 |
| 1922 ... ... | 312,456,000 ... | 14,820 |

**The dividends paid by the Company on the Ordinary Shares during recent years (ending 30th June) were as follows; all less Income Tax:—**

| | |
|---|---|
| **Year 1918 ... ... ...** | **6¼ per cent.** |
| **„ 1919 ... ... ...** | **7 „** |
| **„ 1920 ... ... ...** | **7½ „** |
| **„ 1921 ... ... ...** | **8 „** |
| **„ 1922 ... ... ...** | **9 „** |

**Prospectuses and Forms of Application can be obtained at the office of the Company, Suffolk House, Laurence Pountney Hill, London, E.C. 4 (Telegraphic Address "Assocolgas, Cannon, London." Telephone 7872 City).**

**Prospectuses and Forms of Application can also be obtained from the Company's Solicitor, Auditors, and Bankers.**

*Dated June* 18, 1923.

# STOCK MARKET REPORT.

GENERAL business on the Stock Exchange last week was quiet, and the prevailing tendency was decidedly dull from the gilt-edged category downwards, with crumbling prices. Home Government issues and Indians receded; but Colonials were better. Home Rails were quite out of favour; but Canadians and Argentines were fair. In the Foreign Market, French and German did well; but Turks weakened.

Business in the Gas Market was active and prices were firm without making any big jumps. Debenture stocks were marked *ex div.*

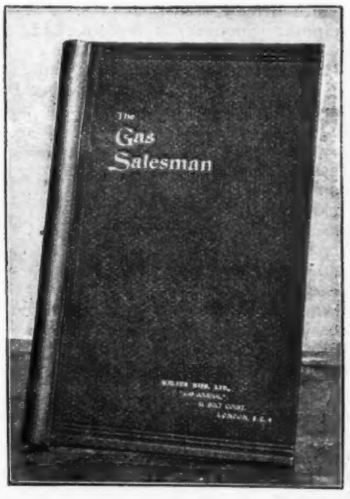
The following transactions in gas during the week were recorded: On Monday, British "A" ordinary 12$\frac{13}{16}$, European 9, Gas Light ordinary 99$\frac{3}{4}$, 100, 100$\frac{1}{2}$, 100$\frac{1}{4}$, 100$\frac{3}{8}$, 100$\frac{1}{8}$, ditto 3$\frac{1}{2}$ p.ct. maximum 67$\frac{1}{4}$, 68$\frac{1}{4}$, ditto 4 p.ct. preference 82$\frac{3}{4}$, Imperial Continental 165, 167$\frac{1}{4}$, ditto 3$\frac{1}{2}$ p.ct. debenture 76$\frac{1}{2}$, Maidstone 110$\frac{1}{4}$, Primitiva 8s., ditto 5 p.ct. preference 36s., South Metropolitan 99, 99$\frac{1}{4}$, ditto 3 p.ct. debenture 63$\frac{3}{4}$, 64$\frac{1}{2}$, ditto 6$\frac{1}{2}$ p.ct. debenture 106$\frac{1}{2}$. On Tuesday, Alliance and Dublin 4 p.ct. debenture 66$\frac{1}{8}$, Bournemouth 4 p.ct. debenture 81, Brentford "A" 104, 104$\frac{3}{4}$, Buenos Aires 4 p.ct. debenture 57$\frac{1}{8}$, Commercial 4 p.ct. 98$\frac{1}{4}$, Continental Union 45, 46, Gas Light ordinary 99$\frac{3}{4}$, 100, 100$\frac{1}{8}$, 100$\frac{1}{2}$, ditto 3$\frac{1}{2}$ p.ct. maximum 67$\frac{1}{4}$, Hong Kong 15, 15$\frac{1}{4}$, Imperial Continental 166, 166$\frac{1}{2}$, 167$\frac{1}{2}$, Primitiva 8s. 3d., South Metropolitan 99, 99$\frac{3}{4}$, Swansea 6$\frac{1}{2}$ p.ct. debenture 107, Tottenham "B" 104$\frac{1}{2}$, Brighton and Hove 4 p.ct. debenture 80, 81, Northampton 5 p.ct. 81, Watford 5 p.ct. 94. On Wednesday, Alliance and Dublin 72, 73$\frac{1}{2}$, Cape Town 4$\frac{1}{2}$ p.ct. debenture 75, Commercial 4 p.ct. 98$\frac{1}{4}$, European 9, Gas Light ordinary 99$\frac{1}{2}$, 99$\frac{3}{4}$, 100, 100$\frac{1}{8}$, 100$\frac{1}{4}$, ditto 3$\frac{1}{2}$ p.ct. maximum 68$\frac{1}{4}$, ditto 4 p.ct. preference 82$\frac{1}{4}$, Imperial Continental 166, 166$\frac{1}{2}$, 167, ditto 3$\frac{1}{2}$ p.ct. debenture 77, Liverpool 7 p.ct. preference 108, Monte Video 57, Primitiva 5 p.ct. preference 36s., 36s. 9$\frac{3}{4}$d., South Metropolitan 99$\frac{3}{4}$, Swansea 6$\frac{1}{2}$ p.ct. debenture 107$\frac{1}{2}$, Colonial Gas Association 17s., ditto preference 16s. On Thursday, Alliance and Dublin 72$\frac{1}{2}$, Brentford "A" 104, Commercial 98$\frac{1}{4}$, Continental Union 45, 46, Gas Light ordinary 99$\frac{1}{2}$, 99$\frac{3}{4}$, 100$\frac{1}{8}$, 100$\frac{1}{4}$, 100$\frac{3}{8}$, 100$\frac{1}{2}$, ditto 4 p.ct. preference 82$\frac{3}{4}$, Imperial Continental 165, 166$\frac{1}{4}$, 166$\frac{1}{2}$, Newcastle 3$\frac{1}{2}$ p.ct. debenture 69$\frac{1}{2}$, Portsea Island "B" 106$\frac{1}{2}$, ditto "C" 104, Primitiva 5 p.ct. preference 36s. 3d., 37s. 3d., San Paulo 6 p.ct. preference 6, South Metropolitan 99$\frac{1}{2}$, South Suburban 5 p.ct. debenture 98$\frac{3}{8}$, Hampton Court 5 p.ct. 108$\frac{1}{2}$ Portsea Island 4 p.ct. debenture 75, Wandsworth 3$\frac{1}{2}$ p.ct. new issue 102$\frac{3}{8}$, Malta and Mediterranean 2nd preference 5, 5$\frac{3}{16}$. On Friday, Aldershot 4 p.ct. preference 74, Bournemouth 5 p.ct. 11$\frac{1}{4}$, ditto "B" 12$\frac{1}{4}$, ditto 5 p.ct. preference 10$\frac{1}{4}$, Commercial 4 p.ct. 99$\frac{1}{4}$, Continental Union 45$\frac{3}{4}$, Gas Light ordinary 99$\frac{1}{2}$, 99$\frac{3}{4}$, 100, 100$\frac{1}{4}$, 100$\frac{3}{8}$, 100$\frac{1}{2}$, ditto 4 p.ct. preference 82$\frac{1}{4}$, Hong Kong 15, Imperial Continental 165, 165$\frac{1}{2}$, 167, Liverpool 5 p.ct. ordinary 92$\frac{1}{2}$, 93, ditto 7 p.ct. preference 107$\frac{1}{2}$, Primitiva 7s. 6d., San Paulo 6 p.ct. preference 5$\frac{7}{8}$, South Metropolitan 99, 99$\frac{1}{2}$, 99$\frac{3}{4}$, ditto 3 p.ct. debenture 63$\frac{1}{4}$, 63$\frac{3}{4}$, 64$\frac{1}{4}$, 64$\frac{3}{4}$, South Suburban 5 p.ct. debenture 98$\frac{3}{8}$, Hampton Court 5 p.ct. 110.

In the Money Market there were moderate fluctuations almost daily; but available supplies being fully adequate to meet requirements, no inconvenience resulted. Discount rates were firm. Silver was fairly steady The Bank of England rate was 3 p.ct., as fixed on July 13.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S TRANSACTIONS.

| Issue. | Share. | When ex-Dividend. | Ante-War Dividend & Bonus. | Last Dividend. | NAME. | Closing Prices, July 30, 1914. | Present Prices. | Lowest and Highest Prices of Transactions |
|---|---|---|---|---|---|---|---|---|
| £ | | | p.c. | | | | | |
| 131,978 | Stk. | Feb. 22 | — | 5% | Aldershot 5 p.c. max. C. | .. | 74—79 | ... |
| 190,492 | ,, | ,, | 4 | 4% | Do. 4 p.c. Pref. | .. | 72—77 | 74 |
| 1,551,868 | ,, | Apl. 5 | 2½ | 5% | Alliance & Dublin Ord | 59—64 | 70—75 | 72½—73½ |
| 374,000 | ,, | Jan. 11 | 4 | 4% | Do. 4 p.c. Deb. | 76—79 | 63—68 | 66½ |
| 280,000 | 5 | May 17 | 7½ | 4/- | Bombay, Ltd. . . | 5¼—6¼ | 5—5½ | ... |
| 100,000 | 5 | Feb. 22 | 16 | 8/- | Bournemouth Gas and Water { 5 p.c. . | .. | 11—12 | 11½ |
| 383,110 | 10 | ,, | 7 | 7/- | { B 7 p.c. | 13—15½ | 12—13 | 12½ |
| 115,000 | 10 | ,, | 6 | 6/- | { Pref. 6 p.c. | 13½—14 | 10½—11½ | 11¼ |
| 162,065 | — | Dec. 29 | — | 4% | { 4 p.c. Deb | .. | 77—82 | 81 |
| 992,045 | Stk. | Feb. 22 | 14 | 61/- | Brentford A Consolid. | 261—266 | 102—107 | 104—104½ |
| 734,920 | ,, | ,, | 11 | 61/3 | Do. B New . | 204—209 | 102—107 | ... |
| 55,000 | ,, | ,, | 5 | 5% | Do. 5 p.c. Pref. | 109—111 | 85—90 | ... |
| 221,400 | ,, | June 14 | 4 | 4% | Do. 4 p.c. Deb. | 91—93 | 77—82* | ... |
| 214,775 | ,, | Mar. 8 | 11 | 11¼% | Brighton & Hove Orig. | 208—213 | 175—180 | ... |
| 244,200 | ,, | ,, | 8 | 8¼% | Do. A Ord. Stk | 154—159 | 130—135 | ... |
| 1,272,500 | Stk. | Feb. 22 | 5 | 5% | Bristol 5 p.c. max. . | .. | 95—96 | ... |
| 570,000 | 20 | Mar. 22 | 12½ | 10/- | British A Ord. . . . | 44—45 | 12½—13½ | 12½ |
| 10,000 | 10 | Dec. 29 | — | 7/- | Do. 7 p.c. Pref. | .. | 12—13 | ... |
| 120,000 | Stk. | June 29 | 4 | 4% | Do. 4 p.c. Deb. Stk | 88—90 | 75—80 | ... |
| 220,335 | ,, | Dec. 29 | 4 | 4% | Buenos Aires 4 p.c. Deb. | 85—87 | 57—60 | 57½ |
| 100,000 | 10 | May 17 | — | — | Cape Town & Dis., Ltd. | 1¼—2¼ | 6¼—7¼ | ... |
| 100,000 | 10 | May 3 | — | 4/6 | Do. 4½ p.c. Pref. | 4—6 | 6—7 | ... |
| 100,000 | Stk. | Dec. 29 | 4½ | — | Do. 4½ p.c. Deb. Stk | 70—75 | 72—77 | 75 |
| 237,860 | ,, | ,, | — | 7½% | Cardiff 7½ p.c. Deb. . . | .. | 109—114 | ... |
| 137,150 | ,, | Feb. 26 | 5 | 5% | Chester 5 p.c. Ord. . | 108—110* | .. | ... |
| 1,513,280 | ,, | Mar. 8 | 5/9/4 | 60/- | Commercial 4 p.c. Stk. | 106—108 | 97—100 | 98½—99½ |
| 560,000 | ,, | ,, | 5½ | 60/- | Do. 3½ p.c. do | 103—105 | 97—100 | ... |
| 475,000 | ,, | June 14 | 3 | 3% | Do. 3 p.c. Deb. Stk. | 69½—71½ | 56—61* | ... |
| 800,000 | ,, | Dec. 15 | 4 | — | Continental Union, Ltd | 76—79 | 42—47 | 45—46 |
| 200,000 | ,, | Dec. 14 | 7 | 4% | Do. 7 p.c. Pref. | 115—118 | 70—75 | ... |
| 660,000 | | Mar. 8 | — | 6% | Croydon sliding scale. | .. | 103—106 | ... |
| 284,975 | | ,, | — | 5% | Do. max. div. . . | .. | 83—86 | ... |
| 492,270 | Stk. | ,, | 6 | 4½% | Derby Con. Stk. . . | 123—125 | .. | ... |
| 55,000 | ,, | — | 4 | 4% | Do. Deb. Stk. | 102—104 | .. | ... |
| 209,000 | ,, | Apl. 5 | — | 5% | East Hull 5 p.c. max. . | .. | .. | ... |
| 1,002,180 | 10 | Jan. 25 | 10 | 5/0 | European, Ltd. . . . | 17½—18 | 9—10 | 9 |
| 16,546,120 | Stk. | Feb. 8 | 4/17/4 | 52/- | Gas Light and Coke { 4 p.c. Ord . . . | 98—102 | 99½—101½ | 99½—100½ |
| 2,600,000 | ,, | ,, | 3½ | 35/- | { 3½ p.c. max. . | 76—79 | 67—69 | 67½—68½ |
| 4,062,235 | ,, | ,, | 4 | 4% | { 4 p.c. Con. Pre. . | 96—99 | 81—83 | 82½—82½ |
| 4,761,930 | ,, | June 14 | 3 | 3% | { 3 p.c. Con. Deb. | 72½—74½ | 61—64* | ... |
| 130,000 | ,, | Dec. 11 | 10 | 10% | { 10 p.c. Bonds . | .. | .. | ... |
| — | — | — | — | — | { 7½ p.c. Ilford Deb. | .. | .. | ... |
| 82,500 | ,, | Mar. 8 | 5 | 65/7½ | Hastings & St. L. 5 p.c. | .. | 92—97 | ... |
| 258,740 | ,, | ,, | 3½ | 50/7½ | Do. 3½ p.c. | 87—89 | 75—78 | ... |
| 70,000 | 10 | May 17 | 11 | 10% | Hongkong & China, Ltd. | 16¼—16½ | 15—16 | 15—15½ |
| 86,600 | Stk. | Mar. 8 | 9 | 9¼% | Hornsey 7 p.c. . . . | .. | 147—152 | ... |
| 1,976,000 | ,, | May 31 | 9 | £17 | Imperial Continental . | 150—160 | 163—168 | 165—167½ |
| 404,800 | ,, | Feb. 8 | 3½ | 3½% | Do. 3½ p.c. Deb. Red. | 84—86 | 75—78 | 76½—77 |
| 235,242 | ,, | Mar. 8 | 6½ | 6½% | Lea Bridge Ord. 5 p.c. | 119—121 | 97—102 | ... |
| 2,498,905 | ,, | Feb. 26 | 10 | 37/6 | Liverpool 5 p.c. Ord. . | .. | .. | 92½—93 |
| 600,000 | ,, | Mar. 22 | — | 7% | ,, 7 p.c. Pref. . | .. | 106—109 | 107½—108 |
| 165,736 | ,, | Feb. 22 | 7/5/6 | 80/- | Maidstone 5 p.c. . . | .. | 107—112 | 110½ |
| 63,480 | ,, | Dec. 29 | — | 3% | Do. 3 p.c. Deb . . | .. | 53—58 | ... |
| 75,000 | 5 | June 14 | 6 | 3/6 | Malta & Mediterranean Met. of Melbourne { 4½ p.c. Deb. | 4¼—4¾ | 3¾—4¼* | ... |
| 100,000 | 100 | Apl. 5 | 4½ | 4½% | | 99—101 | 97—100 | ... |
| 541,920 | Stk. | May 17 | 4 | 4% | Monte Video, Ltd. . . | 11½—12 | 57—62 | 57 |
| 1,875,892 | , | Feb. 22 | 4½ | 5½% | Newcastle & Gatsh'dCon. | 98½—99½ | 88½—89½ | ... |
| 850,166 | ,, | ,, | — | 4% | Do. 4 p.c. Pref. Stk. | .. | 76—78 | ... |
| 529,705 | ,, | Dec. 29 | 3½ | 3½% | Do. 3½ p.c. Deb. | 82—83 | 70—72 | 69½ |
| 15,000 | 10 | Aug. 26 | — | 7/6 | North Middlesex 10 p.c. | .. | .. | ... |
| 55,940 | 10 | Mar. 8 | 7/14/0 | 7/8⅞ | ,, ,, 7 p.c. | 14—15 | 12—13 | ... |
| 300,000 | Stk. | May 3 | 8 | 8% | Oriental, Ltd. . . | 117—122 | 97—102 | ... |
| 188,120 | Stk. | Dec. 29 | — | 72/6 | Plym'th & Stonh'se 5 p.c. | .. | 107—112 | ... |
| 60,000 | 50 | Mar. 8 | 13 | 65/- | Portsea Island, B . | 128—131 | 103—108 | 106½ |
| 100,000 | 50 | ,, | 12 | 60/- | Do. C . . | 118—121 | 100—105 | 104 |
| 290,069 | 5 | — | 8 | — | Primitiva Ord. . . . | 5¼—6 | ⅞—1 | 7/6—8/3 |
| 499,960 | 5 | — | 5 | — | Do. 5 p.c. Pref. . | 4¼—5 | 1½—2½ | 36/—37/3 |
| 521,600 | 100 | June 1 | 4 | 4% | Do. 4 p.c. Deb. . | 91—93 | 70—73 | ... |
| 600,000 | Stk. | Jan. 25 | 4 | 4% | Do. ,, ,, 1911 | .. | 57—60 | ... |
| 346,198 | ,, | Dec. 29 | 4 | 4% | River Plate 4 p.c. Deb. | 85—87 | 57—60 | ... |
| 150,000 | 10 | Mar. 22 | 6 | 6/- | San Paulo { 6 p.c. Pref. | 10½—11 | 5¾—6¼ | 5¾—6 |
| 125,000 | 50 | July 3 | 5 | 5% | { 5 p.c. Deb. | 47—49 | 38—41 | ... |
| 135,000 | Stk. | Mar. 22 | 10 | 5% | Sheffield A . . . . | 223—224 | 100—102 | ... |
| 209,984 | ,, | ,, | 10 | 5% | Do. B . . . . | 222—224 | 100—102 | ... |
| 323,500 | ,, | ,, | 10 | 5% | Do. C . . . . | 220—229 | 100—102 | ... |
| 133,201 | Stk. | Sept. 15 | 4 | 4% | Shrewsbury 5 p.c. . . | .. | .. | ... |
| 90,000 | 10 | May 31 | 9 | 9/- | South African . . . | 10½—11½ | 8—10 | ... |
| 6,609,895 | Stk. | Feb. 22 | 5/4/0 | 60/- | South Met. Ord. . . . | 111—113 | 99—101 | 99—99½ |
| 250,000 | ,, | Jan. 11 | — | 5% | Do. Red. Pref. . | .. | 98—100 | ... |
| 1,895,445 | ,, | ,, | 3 | 3% | Do. 3 p.c. Deb. . | 72½—74½ | 63—65 | 63½—64½ |
| 734,000 | ,, | Mar. 8 | — | 6½% | Do. 6½ p.c. Deb. | .. | 105—107 | 106½ |
| 91,500 | ,, | Feb. 22 | 8½ | 8½% | South Shields Con. Stk. | 157—159 | 129—131 | ... |
| 1,087,795 | ,, | ,, | 6 | 6% | S'th Suburb'n Ord. 5 p.c. | 114—116 | 100—103 | ... |
| 368,837 | ,, | Dec. 29 | 5 | 5% | Do. 5 p.c. Deb. Stk. | 116—118 | 95—100 | 98½ |
| 647,740 | ,, | May 3 | 5 | 7% | S'th'mpt'n Ord. 5p.c. max. | 99—102 | 88—91 | ... |
| 121,275 | ,, | Dec. 29 | 4 | 4% | Do. 4 p.c. Deb. Stk. | .. | 73—78 | ... |
| 250,000 | ,, | Mar. 8 | — | 70/- | Swansea 7 p.c. Pref. Stk. | .. | 102½—104½ | ... |
| 200,000 | ,, | Dec. 29 | — | 6½% | Do. 6½ p.c. Deb. Stk. | .. | 106—108 | 107—107½ |
| 120,000 | ,, | Feb. 22 | — | 7½% | Tottenham District { A 5 p.c. . | 135—138 | 123—128 | ... |
| 782,275 | ,, | ,, | 6 | 6% | { B 3½ p.c. . | 115—117 | 102—107 | 104½ |
| 181,255 | ,, | June 14 | 4 | 4% | { 4 p.c. Deb. | 87—89 | 74—79* | ... |
| 258,251 | Stk. | Mar. 22 | 3 | 3% | Tynemouth 5 p.c. max. | 108½—109 | 90—92 | ... |
| | | | | | Wandsworth, Wimbledon, and Epsom— | | | |
| 50,000 | ,, | Feb. 22 | 8½ | 87/6 | Wandsworth A 5 p.c. . | 151—156 | 130—135 | ... |
| 255,636 | ,, | ,, | 6½ | 72/6 | Do. B 3½ p.c. | 129—134 | 115—120 | ... |
| 108,075 | ,, | ,, | — | 61/3 | Do. C. . . . | — | 100—105 | ... |
| 140,865 | ,, | ,, | — | 61/3 | New Ordinary . . | — | 100—105 | ... |
| 152,000 | ,, | ,, | 6½ | 68/9 | Wimbledon 5 p.c. . . | 117—122 | 110—115 | ... |
| 98,000 | ,, | ,, | 6½ | 73/9 | Epsom 5 p.c. . . . | 121—126 | 115—120 | ... |
| 58,426 | ,, | Dec. 29 | 3 | 3% | 3 p.c Deb. Stk. . . | 66—69 | 58—61 | ... |

* Ex. div.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| Hodges, R. J., & Co. | — |
| Holborn Lamp and Sign Works | — |
| Holmes, F. G., & Co., Ltd. | — |
| Holmes, W. C., & Co., Ltd. | — |
| Hooper and Weyman, Ltd. | — |
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| Hydronyl Syndicate, Ltd. | — |
| Jenkins, W. J., & Co., Ltd. | — |
| Jobson and Beckwith, Ltd. | — |
| Johnson, W., Junr. | — |
| Keighley Gas and Oil Engine Company, Ltd. | — |
| Keith, James, and Blackman Company, Ltd. | 766 |
| Kent, Geo., Ltd. | — |
| Kenyon, Alexander, & Co., Ltd. | — |
| Kieselguhr Supplies Co. | 713 |
| King's Patent Agency | 755 |
| Kirkham, Hulett, and Chandler, Ltd. | 712 |
| Laidlaw, R., & Son (Edin.), Ltd. | 764 |
| Laidlaw, R., & Son, Ltd. | 757 |
| Le Grand, Sutcliff, and Gell | — |
| Lead Wool Company, Ltd. | — |
| Lord, J. E. C. (Manchester), Ltd. | 755 |
| Low Temperature Construction, Ltd. | — |
| Main, R. & A., Ltd. | 706 |
| McKelvie, James, & Co. | Wrapper I. |
| Meldrums Limited | — |
| Messenger & Sons | — |
| Mewburn, Ellis, & Co. | 755 |
| Midland Builders Supply. | — |
| Midland Railway Carriage and Wagon Co., Ltd. | — |
| Mitchell, H. | Wrapper I. |
| Moore, Walter, & Sons | — |
| Morden, S. H., & Co., Ltd. | — |
| Neill & Son, Ltd. | — |
| New Conveyor Co., Ltd. | 760 |
| New Inverted Incandescent Gas Lamp Co., Ltd. | — |
| Newton, Chambers, & Co., Ltd. | — |
| Orme, George, & Co. | 704 |
| Oughtibridge Silica Firebrick Company, Ltd. | — |
| Page, Chas., & Co., Ltd. | Centre VII. |
| Parkinson and W. & B. Cowan, Ltd. | 758 |
| Parkinson Stove Company, Ltd. | — |
| Parkinson, W., & Co. | 716 |
| Peckett & Sons, Ltd. | 710 |
| Peebles & Co., Ltd. | 762 |
| Penney and Porter, Ltd. | — |
| Penningtons Engineering Tutors | — |
| Perch, William, Ltd. | 757 |
| Pifco, Ltd. | — |
| Piggott, Thos., & Co., Ltd. | — |
| Pocock, Herbert | Wrapper I. |
| Podmore, A. E., & Co. | — |
| Potterton, Thos. | — |
| Procter, E. W. | — |
| Pulsometer Engineering Company, Ltd. | — |
| Radiation, Ltd. | Centre IV., V. |
| Ramie Company, Ltd. | — |
| Ratcliffe and Sons (Hawarden), Ltd. | — |
| Reavell & Co., Ltd. | 761 |
| Richmond Gas Stove & Meter Co., Ltd. | — |
| Ride and Bell, Ltd. | — |
| Riley, John, & Sons, Ltd. | 755 |
| Robson, Geo., & Co. | 757 |
| Rotary Meter Company, Ltd. | 710 |
| Sawer & Purves | — |
| Serck Tubes, Ltd. | — |
| Shields & Ramsay | — |
| Sigma Instrument Company | Wrapper II. |
| Simon-Carves, Ltd. | 703 |
| Simplex Concrete Piles, Ltd. | — |
| Smith, J. & W. B., Ltd. | — |
| Smith Meters, Ltd. | — |
| South Metropolitan Gas Company | 758 |
| Spencer-Bonecourt, Ltd. | 763 |
| Spencer Chapman, & Messel, Ltd. | 755 |
| Spencer, Walter, & Sons. | 755, 762 |
| Stanton Ironworks Co., Ltd. | — |
| Stein, J. G., & Co., Ltd. | — |
| Stephenson, Andrew | 755 |
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| Stothert & Pitt, Ltd. | 713 |
| Stringer Bros. | — |
| Sugg, Wm., & Co., Ltd. | 705 |
| Sutherland Meter Company, Ltd. | — |
| Taylor, Joseph, & Co. (Saturators), Ltd. | 755 |
| Telephos, Ltd. | 757 |
| Thermal Syndicate, Ltd. | — |
| Thompson, John (Wolverhampton) Ltd. | 757 |
| Tilley High Pressure Gas Syndicate, Ltd. | — |
| Torbay Paint Company | Wrapper I. |
| Trier Bros., Ltd. | Wrapper IV. |
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| Tully Gas Plants, Ltd. | 755 |
| Turbine Furnace Co., Ltd. | 712 |
| Underfeed Stoker Co., Ltd. | — |
| Vee-Reg Valves—Engineering Specialists, Ltd. | — |
| Vertical Gas Retort Synd., Ltd. | Wrapper I. |
| Vickers, Ltd. | — |
| Vislok, Ltd. | — |
| Volker Lighting Corporation | — |
| Walker, C. & W., Ltd. | 755 |
| Walker, Crosweller, & Co. | 760 |
| Waller, Geo., & Son, Ltd. | 704 |
| Waugh, Walter, & Co. | 757 |
| Welsbach Light Company, Ltd. | — |
| West's Gas Improvement Co., Ltd. | 708, 709, and Supplement |
| Westwood and Wrights | — |
| Whessoe Foundry and Engineering Company, Ltd. | — |
| Wholesale Fittings Company, Ltd. | — |
| Williamson, Cliff, Ltd. | — |
| Willey & Co., Ltd. | Centre VI. |
| Wilson, Carter, and Pearson | — |
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| Wilsons & Mathiesons, Ltd. | — |
| Wood, Hugh, & Co. | — |
| Woodall-Duckham Company | Centre I. |
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